The Enstore Administrator's Guide

December 21, 2012

ABSTRACT

Enstore is the mass storage system implemented at Fermilab as the primary data store for large data sets. Enstore provides access to data on tape or other storage media both local to a user's machine and over networks. It is designed to provide high fault tolerance, availability and scalability sufficient for the current Fermilab and it collaborator needs, as well as easy administration and monitoring. It uses a client-server architecture which provides a generic interface for users and allows for hardware and software components that can be replaced and/or expanded. Enstore is currently intergated with dCache front end which makes up a Hierarchical Data Storage System.
This document describes these tools, how to use them to move data to and from storage media, and how to monitor the progress of jobs through the system.

Revision Record

January 19, 2010	first printing
April 7, 2011	Updated the migration chapter and fixed typos in the PNFS maintenance chapter.
December 21, 2012	Modified abstract, added hyperlinks to TOC

Table of Contents

Chapter 1: Enstore Overview

1.1 Introduction

Enstore is the mass storage system implemented at Fermilab as the primary data store for large data sets. The data is stored on different types of magnetic tapes in robotic tape libraries. Enstore is designed to provide high fault tolerance and availability sufficient for the Run II data acquisition needs, as well as easy administration and monitoring.
It uses a client-server architecture which provides a generic interface for users and allows for hardware and software components that can be replaced and/or expanded.
Enstore has two major kinds of software components:

• the Enstore servers, which are software modules that have specific functions, e.g., maintain database of data files, maintain database of storage volumes, maintain configuration, look for error conditions and sound alarms, communicate user requests down the chain to the tape robots, and so on.

• **encp**, a client program for copying files directly to and from the mass storage system.

Enstore can be used directly only from on-site machines. Off-site users are restricted to accessing Enstore via dCache, and in fact on-site users are encouraged to go through dCache as well.

Enstore supports both automated and manual storage media libraries. It allows for a larger number of storage volumes than slots. It also allows for simultaneous access to multiple volumes through automated media libraries. There is no preset upper limit to the size of a data file in the enstore system; the actual size is limited by the physical resources. The lower limit on the file size is zero. The upper limit on the number of files that can be stored on a single volume is about 5000.

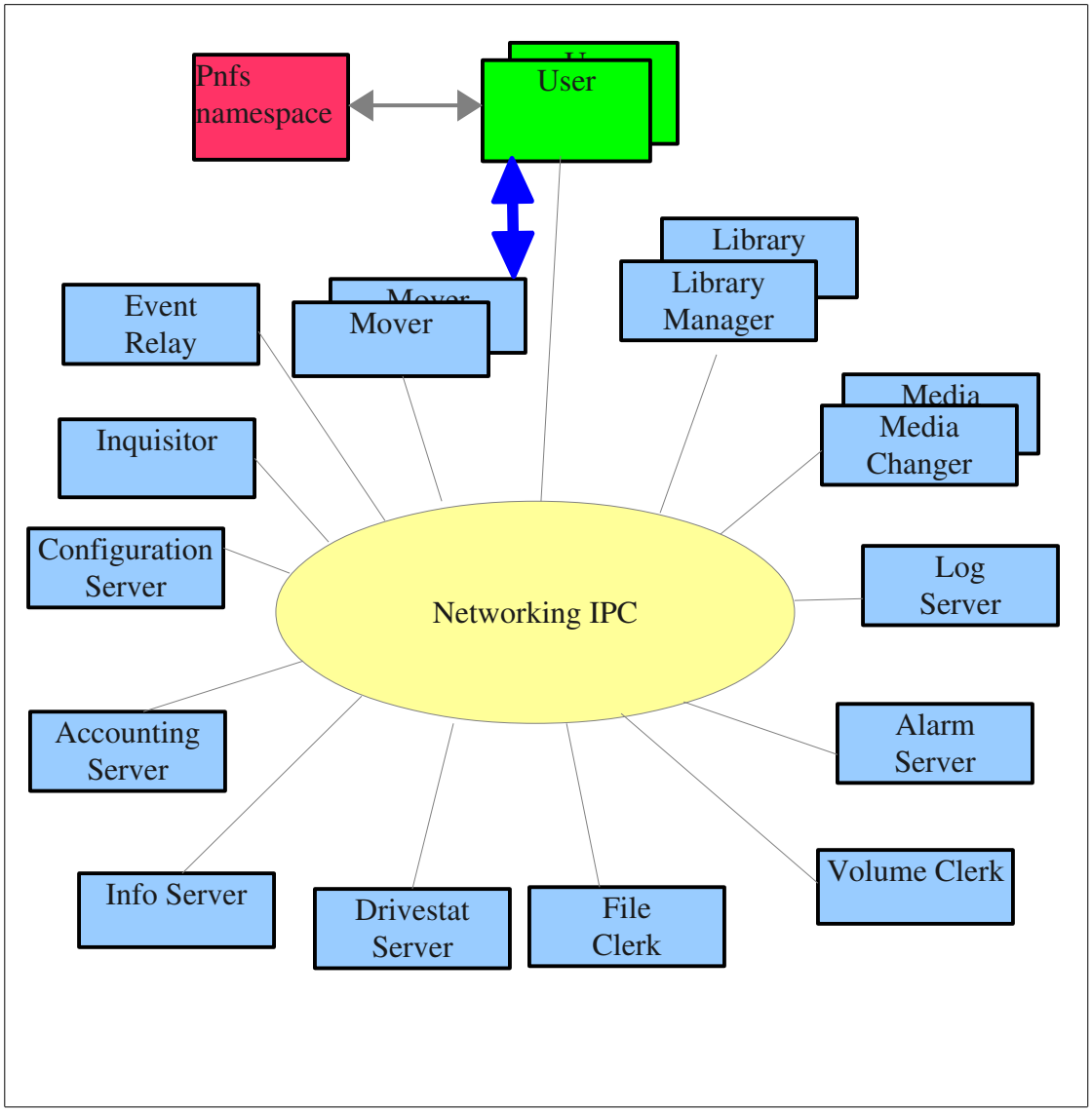
Enstore allows users to search and list contents of media volumes as easily as they search native file systems. The stored files appear to the user as though they exist in a mounted UNIX directory. The mounted directory is actually a distributed virtual file system in PNFS namespace containing metadata for each stored file. Enstore eliminates the need to know volume names or other details about the actual file storage.

There are several installed Enstore systems at Fermilab. Currently these include CDFEN for CDF Run II, D0EN for D0 Run II, and STKEN for all other Fermilab users. Web-based monitoring for the Enstore systems is available at http://www-ccf.fnal.gov/enstore/. Currently, all storage libraries are tape libraries. The Computing Division operates and maintains the tape robots, slots, and other tape equipment, but for the present, experiments provide and manage their own volumes.

1.2 Enstore architecture

The Enstore software architecture is presented in Figure 1. Enstore components are:

- A configuration server keeps the system configuration information and provides it to the rest of the system. Configuration is described in an easily maintainable configuration file.
- A volume clerk maintains the volume database and is responsible for declaration of new volumes, assignments of volumes, user quotas, and volume bookkeeping.
- A file clerk maintains the file database, assigns unique bit file IDs and keeps all necessary information about files written into Enstore.
- Multiple distributed library managers provide queuing, optimization, and distribution of user requests to assigned movers.
- Movers write / read user data to tapes. A mover can be assigned to more than one library manager. A media changer mounts / dismounts tapes in the tape drives at the request of a mover.
- Alarm and log servers generate alarms and log messages from Enstore components correspondingly.
- An accounting server maintains an accounting database containing information about completed and failed transfers and mounts.
- A drivestat server maintains a database with information about tape drives and their usage.
- An inquisitor monitors the state of the Enstore components.
- PNFS namespace server implements a name space that externally looks like a set of Network File Systems.
- Events are used in the Enstore system to inform its components about changes in the configuration, completed and ongoing transfers, states of the servers, etc. An event relay transmits these events to its subscribers.



All Enstore components communicate using IPC based on UDP. Great care has been taken to provide reliable communications under extreme load conditions. The user command, encp, retries in case of an internal Enstore error. The number of user computers is not restricted, and Enstore components can be distributed over unlimited number of nodes, tape libraries and tape drives.

1.3 Enstore hardware requirements and configuration

Enstore is a distributed and scalable system. It can be installed on a single Linux node, but for the better performance the following needs to get taken into consideration. Enstore has several databases which are used quite extensively depending on the number of data transfer requests. Modern tape drives have transfer rates in the order of 100MB/s. Having this in mind the following recommendations for hardware layout and system configuration are

suggested.

1.3.1 Hosts

There are no strict requirements for hosts. The general requirements are:

1. dual CPU Intel processor (3.0GHZ or better),
2. 1MB (or more, better 2MB) of RAM
3. 120MB (or more) system disk
4. 1Gb (or more) network adapter for data transfer
5. 100 Mb network adapter - not necessary but it comes with the system anyway and can be used for private LAN connection with robotic library controller
6. Tape drive adapter (whichever is appropriate (SCSI, Fiber Channel) for **mover** node

1.3.2 Additional storage

Additional storage may be needed for large systems to hold databases, system information, log files, etc. It can be any kind of appropriate raid arrays. For better flexibility of the system you may want to considered some kind on NAS, such as Raid arrays connected to hosts via Fiber Channel switch.

1.3.3 Network switch

There no strict requirements for the network switch other than it should provide an adequate connection and transfer rates between enstore components as well as client hosts and tape movers.

1.3.4 System Configuration

We recommend to have the following configuration:
For the small system (one robotic library with one or 2 tape drives and few thousands tapes).
Minimal configuration:

1. host1: pnfs server, Apache web server, configuration_server, log_server, alarm_server, inquisitor, event_relay, ratekeeper, postgres DB server, file_clerk, volume_clerk, info_server, accounting_server, drivestat_server
2. host2: media_changer(s), library_manager(s), mover

*** Note that this configuration may have problems as the number of accesses and their rates increase. It is always better to run one mover
on a separate host

Recommended configuration:

1. host1 : pnfs server
2. host2: Apache web server, configuration_server, log_server, alarm_server, inquisitor, event_relay, ratekeeper
3. host3: media_changer(s), library_manager(s)
4. host4: postgres DB server, file_clerk, volume_clerk, info_server, accounting_server, drivestat_server
5. host5: backups, plots, migration work, etc. This can be done on one of existing hosts but may interfere with operations.
6. one host per mover.

Chapter 2: Enstore Commands

Enstore provides commands that allow you to communicate with various components of the system. The basic syntax of all Enstore commands is

```
% enstore <command> [--option [argument] ...]
```

All options start with a double dash (**--**). The return codes are 0 (zero) for success, non-zero for failure (currently all failures return number 1).

2.1 enstore info

As of encp v3_2, the command **enstore info** supersedes **enstore file** and **enstore volume**. The developers may decide to remove these latter two commands in future versions of **encp**.

This command communicates with the File Clerk (see section 8.1 *File Clerk*) and the Volume Clerk (see section 8.2 *Volume Clerk*). It returns information about specified file(s) or volume(s).

Syntax:

```
% enstore info [--option [argument] ... ]
```

Options:

-h, --help
Prints the options (i.e., prints this message). Example:

```
$ enstore info --help
    Usage:
           info [ -h --bfid= --help --list= --ls-active= --usage ]
           --bfid <BFID>         get info of a file
           --file <PATH|PNFSID|BFID|VOL:LOC>  get info on a file
           --find-all-copies <BFID>  find all copies of this file
           --find-copies <BFID>  find the immediate copies of this file
             --find-duplicates <BFID>  find all duplicates related to
    this file
           --find-original <BFID>  find the immediate original of this
    file
           --find-the-original <BFID>  find the very first original of
    this file
               --gvol <VOLUME_NAME>   get info of a volume in human
    readable time
                                format
       -h, --help                print this message
           --just <VOLUME_NAME>  used with --pvols to list problem
           --list <VOLUME_NAME>  list the files in a volume
           --ls-active <VOLUME_NAME>  list active files in a volume
           --ls-sg-count         list all sg counts
           --pvols               list all problem volumes
```

```
--show-bad            list all bad files
--show-copies <BFID>  all copies of a file
--show-file <BFID>    show info of a file
--usage               print short help message
--vol <VOLUME_NAME>   get info of a volume
--vols                list all volumes
```

--bfid <BFID>
Returns information (metadata) about the file corresponding to the specified bfid.
You can get the bfid of a file from the **`enstore pnfs --bfid <FILE_NAME>`** command (section Error: Reference source not found); get the filename from searching PNFS namespace.
Example:

```
$ enstore info --bfid CDMS105770745000000
{'bfid': 'CDMS105770745000000',
 'complete_crc': 1191066979L,
 'deleted': 'no',
 'drive': 'stkenmvr7a:/dev/rmt/tps0d1n:4560000022',
 'external_label': 'VO3222',
 'location_cookie': '0000_000000000_0005661',
 'pnfs_mapname': '',
                                                    'pnfs_name0':
'/pnfs/fs/usr/test/xyz/srmtest/ar017983.0001phys_10',
 'pnfsid': '000500000000000000190EA8',
 'pnfsvid': '',
 'sanity_cookie': (65536L, 3203712884L),
 'size': 197354833L}
```

--find-all-copies <BFID>
Report all the file BFIDs that are duplicates or multiple copies of the specified file BFID, including the specified file itself.
Multiple copies are extra copies of a file written by the same encp process that wrote the original file. Duplicated copies are

multiple copies that were written to another tape by the Enstore administrators some time after the original was written to tape.

Here are two files where the first BFID shone is the original and the second one is a duplicate of the first.

```
$ enstore info --find-all-copies
  CDMS115788240600000

    CDMS115788240600000
    CDMS123800281300002

$ enstore info --find-all-copies
  CDMS123800281300002

    CDMS123800281300002
```

See also **encp--copies**; **enstore info --find-copies**, **--find-duplicates**, **--find-original**, --**find-the-original** and **--show-copies** for more information.

--find-copies <BFID>
Report the file BFIDs that are immediate duplicates or multiple copies of the specified file BFID, including the specified file itself. Multiple copies are extra copies of a file written by the same encp process that wrote the original file. Duplicated copies are multiple copies that were written to another tape by the Enstore administrators some time after the original was written to tape.

Here are two files where the first BFID shone is the original and the second one is a duplicate of the first.

```
$ enstore info --find-copies CDMS115788240600000

    CDMS123800281300002

$ enstore info --find-copies CDMS123800281300002
```

See also **encp--copies**; **enstore info --find-all-copies**, **--find-duplicates**, **--find-original**, --**find-the-original** and **--show-copies** for more information.

--find-duplicates <BFID>
Report the file BFIDs that are associated as a duplicate or multiple copy file of the specified file BFID, including the specified file itself. This command has the same effect as:

$ enstore info --find-all-copies `enstore info --find-the-original <BFID>` Multiple copies are extra copies of a file written by the same encp process that wrote the original file. Duplicated copies are multiple copies that were written to another tape by the Enstore administrators some time after the original was written to tape.

Here are two files where the first BFID shone is the original and the second one is a duplicate of the first.

```
$ enstore info --find-duplicates
  CDMS115788240600000

    CDMS115788240600000
    CDMS123800281300002

$ enstore info --find-duplicates
  CDMS123800281300002

    CDMS115788240600000
    CDMS123800281300002
```

See also **encp--copies**; **enstore info --find-all-copies**, **--find-copies**, **--find-original**, --**find-the-original** and **--show-copies** for more information.

--find-original <BFID>
Report the file BFIDs that is the immediate original of the specified duplicate or multiple copy file BFID. Multiple copies are extra copies of a file written by the same encp process that wrote the original file. Duplicated copies are multiple copies that were written to another tape by the Enstore administrators some time after the original was written to tape.

Here are two files where the first BFID shone is the original and the second one is a duplicate of the first.

```
$ enstore info --find-original
  CDMS115788240600000

    None

$ enstore info --find-original
  CDMS123800281300002

    CDMS115788240600000
```

See also **encp--copies**; **enstore info --find-all-copies**, **--find-copies**, **--find-duplicates**, --**find-the-original** and

--show-copies for more information.

--find-the-original <BFID>
Report the file BFIDs that is the overall original of the specified duplicate or multiple copy file BFID. Multiple copies are extra copies of a file written by the same encp process that wrote the original file. Duplicated copies are multiple copies that were written to another tape by the Enstore administrators some time after the original was written to tape.

Here are two files where the first BFID shone is the original and the second one is a duplicate of the first.

```
$ enstore info --find-the-original
  CDMS115788240600000

    CDMS115788240600000

$ enstore info --find-the-original
  CDMS123800281300002

    CDMS115788240600000
```

See also **encp--copies**; **enstore info --find-all-copies**, **--find-copies**, **--find-duplicates**, --**find-original** and**--show-copies** for more information.

This option may be used in any of four ways to return the same information, depending on what information you initially know about the file.
--file <PATH>
--file <BFID> (equivalent to **`enstore info --bfid <BFID>`**)
--file <PNFSID>
--file <VOLUME:LOCATION>
Returns information on the specified file.
This example uses the path:

```
$ enstore info --file /pnfs/test/NULL/1KB_251
```

```
{'bfid': 'WAMS111453908000000',
 'complete_crc': 0L,
 'deleted': 'no',
 'drive': 'rain:/dev/null:0',
 'external_label': 'NULL01',
 'gid': 6209,
 'location_cookie': '0000_000000000_0000609',
 'pnfs_name0': '/pnfs/test/NULL/1KB_251',
 'pnfsid': '00010000000000000056258',
 'sanity_cookie': (1024L, 0L),
 'size': 1024L,
 'uid': 5744}
```

The file could also be specified as one of the following (BFID, PNFSID or VOLUME:LOCATION (external_label:location_cookie):

```
$ enstore info --file WAMS111453908000000

$ enstore info --file 00010000000000000056258

$ enstore info --file
  NULL01:0000_000000000_0000609
```

--gvol <VOLUME_NAME>

This is just like **`enstore info --vol <VOLUME_NAME>`**, except that this one prints human-readable time fields (e.g., “declared”, “first_access” and “last_access” fields). Example:

```
$ enstore info --gvol VO3332
```

```
{'blocksize': 131072,
 'capacity_bytes': 64424509440L,
 'declared': 'Wed Jan 16 16:13:57 2002',
 'eod_cookie': '0000_000000000_0000044',
 'external_label': 'VO3332',
 'first_access': 'Fri May 10 12:59:35 2002',
 'last_access': 'Mon Oct 27 22:35:45 2003',
 'library': '9940',
 'media_type': '9940',
 'non_del_files': 43,
 'remaining_bytes': 1785262080L,
 'sum_mounts': 234,
 'sum_rd_access': 213,
 'sum_rd_err': 0,
 'sum_wr_access': 43,
 'sum_wr_err': 0,
 'system_inhibit': ['none', 'full'],
 'user_inhibit': ['none', 'none'],
 'volume_family': 'cms.objy_data_files.cpio_odc',
 'wrapper': 'cpio_odc'}
```

--just

Used with **`--pvols`** to list problem. See **`enstore info --pvols`**.

--list <VOLUME_NAME>
Lists the files in the specified volume with their volume name, bfid, size, location (file number) on volume, delete flag, and the original filename in pnfs.
You can get the volume name from the **`enstore pnfs`** command, using either **`--xref`** or **`--layer`** (section Error: Reference source not found), or from the "external_label" field of the **`enstore info --bfid <BFID>`** command (shown above).
This replaces both **`enstore file --list <VOLUME_NAME>`** and **`enstore volume --list <VOLUME_NAME>`**.
Example:

```
$ enstore info --list VO3222

    label  bfid               size   location_cookie        delflag
    original_name

    VO3222 CDMS106503213600000 983803 0000_000000000_0011536 deleted
    /pnfs/fs/usr/eagle/dcache-tests/274.dcache_page_p_27750
```

(This shows one of many lines appearing in the real output, and is reformatted to two lines for readability.)

--ls-active <VOLUME_NAME>
Lists active files in a volume.
You can get the volume name from the **`enstore pnfs`** command, using either **`--xref`** or **`--layer`** (section Error: Reference source not found), or from the "external_label" field of the **`enstore info --bfid <BFID>`** command (shown above).
Example:

```
$ enstore info --ls-active VO3222

    /pnfs/fs/usr/eagle/dcache-tests/101.dcache_page_a_24401
    /pnfs/fs/usr/eagle/dcache-tests/101.dcache_page_24401
    /pnfs/fs/usr/test/stress-test/myfile1
    /pnfs/fs/usr/test/stress-test/myfile3
    /pnfs/fs/usr/test/stress-test/file128m-11
    ...
```

--ls-sg-count <VOLUME_NAME>
Lists allocated tape counts by library and by storage group. If "storage group" has value "none", the negative number under "allocated" gives the number of tapes that are available in the robot, but not yet assigned to a storage group.
Example:

```
$ enstore info --ls-sg-count VO3332
```

```
      library    storage group  allocated
=======================================
       ...
       9940             ktev        189
        9940             lqcd        150
        9940        miniboone        132
        9940            minos        109
        9940             none        -13
        9940          patriot         20
        9940             sdss        608
        9940             test         28
        9940           theory         70
    CD-9940B              cms        129
        ...
```

--pvols [--just <VOLUME_1> <VOLUME_2> ...]
Without **`--just`**, this lists all problem volumes. With **`--just`** followed by a space-separated list of volume names, it lists only the problem volumes among the given list.
The columns returned are: volume name, primary status, primary status time, secondary status, secondary status time. (The time fields are relatively new; not all volumes will display them.)
Example:

```
$ enstore info --pvols
```

```
==== readonly
LEGL10             none         *     readonly 0913-1540
LEGL98             none         *     readonly 0819-2329
...
==== full
...
VO4845             none         *         full         *
VO4846             none 1023-1032         full         *
VO4847             none         *         full         *
VO4848             none         *         full         *
VO4849             none         *         full         *
VO4850             none         *         full 1016-2315
VO4851             none         *         full 1017-0409
...
$ enstore volume --pvols --just VO3332
```

```
(no sample output available)
```

--show-bad
Lists all files that are currently unavailable due to media problems. When a tape problem is discovered, the tape is sent to the vendor for file recovery. In the interim, a cloned tape is made available to users, with the bad files marked. This command option lets you list the bad files. The output lists the tape number, BFID, file size in bites, and pnfs path of file.
Example:

```
$ enstore info --show-bad

...
VO0053 CDMS105770745000000 95530315
 /pnfs/fs/usr/xyz/my_data/2004-4/.bad.F000xyz43_0000.mdaq.root
...
```

We show only one output line, and it is displayed on two lines for readability. Notice the "`.bad.`" at the front of the filename; this is how the bad files are marked.

--show-copies <BFID>
Report the file BFIDs that are associated as a duplicate or multiple copy file of the specified file BFID, including the specified file itself. This command has a similar effect to:
$ enstore info --find-duplicates <BFID>
but outputs more information. Multiple copies are extra copies of a file written by the same encp process that wrote the original file. Duplicated copies are multiple copies that were written to another tape by the Enstore administrators some time after the original was written to tape.

Here are two files where the first BFID shone is the original and the second one is a duplicate of the first. The columns are the BFID, Storage Group, Library, Media Type, Label, Deleted Status, Size, CRC, PNFS ID and Original PNFS Path.

```
$ enstore info --show-copies CDMS115788240600000

  CDMS115788240600000      ENDEV        LTO3        LTO3     TEST85
0000_000000000_0000001           no      5290065920      3951343656
00020000000000000003DD20
/pnfs/data2/sl8500/fcdfcaf566/fcdfcaf566_4000_1157882036.data
  CDMS123800281300002      ENDEV        LTO3        LTO3     TEST21
0000_000000000_0000001           no      5290065920      3951343656
00020000000000000004C4D8
/pnfs/data2/sl8500/fcdfcaf566/fcdfcaf566_4000_1157882036.data

$ enstore info --show-copies CDMS123800281300002

  CDMS115788240600000      ENDEV        LTO3        LTO3     TEST85
0000_000000000_0000001           no      5290065920      3951343656
00020000000000000003DD20
/pnfs/data2/sl8500/fcdfcaf566/fcdfcaf566_4000_1157882036.data
  CDMS123800281300002      ENDEV        LTO3        LTO3     TEST21
0000_000000000_0000001           no      5290065920      3951343656
00020000000000000004C4D8
/pnfs/data2/sl8500/fcdfcaf566/fcdfcaf566_4000_1157882036.data
```

See also **encp--copies**; **enstore info --find-all-copies**, **--find-copies**, **--find-original**, --**find-the-original**, **--show-copies** and **--show-file** for more information.

--show-file <BFID>
Display information about the file specified by its BFID and some information about the volume where the file is located. The columns are the BFID, Storage Group, Library, Media Type, Label, Deleted Status, Size, CRC, PNFS ID and Original PNFS Path.

```
$ enstore info --show-file GCMS125028149900000

   GCMS125028149900000         gcc        LTO3        LTO3     TEST11
0000_000000000_0006692          yes              2532     3516567016
```

```
0001000000000000045BC440      /pnfs/fnal.gov/testers/NULL/20090814-
213844-23461-0.txt
```

See also **enstore info --bfid** and**--show-copies** for more information.

--usage
Prints short help message. Example:

```
$ enstore info --usage

Usage:
       info [ -h --bfid= --help --list= --ls-active= --usage ]
```

--vol <VOLUME_NAME>
Returns detailed information about specified volume
Example:

```
$ enstore info --vol VO3332

{'blocksize': 131072,
 'capacity_bytes': 64424509440L,
 'declared': 1011219237.849051,
 'eod_cookie': '0000_000000000_0000044',
 'external_label': 'VO3332',
 'first_access': 1021053575.259737,
 'last_access': 1067315745.238969,
 'library': '9940',
 'media_type': '9940',
 'non_del_files': 43,
 'remaining_bytes': 1785262080L,
 'sum_mounts': 234,
 'sum_rd_access': 213,
 'sum_rd_err': 0,
 'sum_wr_access': 43,
 'sum_wr_err': 0,
 'system_inhibit': ['none', 'full'],
 'user_inhibit': ['none', 'none'],
 'volume_family': 'cms.objy_data_files.cpio_odc',
 'wrapper': 'cpio_odc'}
```

--vols
or
--vols <VOLUME_STATUS>
or
--vols <KEY> <VALUE>
Lists all volumes with their available space, the system inhibits, the library, the volume family (period-separated concatenation of storage group, file family and file family wrapper) and any comments.
The VOLUME_STATUS argument is optional. If left off, all volumes are listed. Possible values for this argument include: NOACCESS, NOTALLOWED, full, read_only, migrated.
The KEY option accepts: storage_group, library and media_type
Example:

```
$ enstore info --vols
```

```
label          avail.    system_inhibit      library    vol_family
comment
...
VO0053            1.19GB      (none      full   )            eagle
cms.objy_data_files.cpio_odc
VO0054            0.51GB      (none      full   )            eagle
cms.objy_data_files.cpio_odc
VO0055    0.17GB  (none  full )    eagle    theory.theory-canopy-
C.cpio_odc
VO0056    0.65GB  (none  full )    eagle    theory.theory-canopy-
D.cpio_odc
...
```

2.2 enstore library

This command communicates with the Library Manager (see section 8.3 *Library Manager*). You can use it to get information pertaining to a particular Library Manager. Use the online monitoring pages (see Chapter 10: *Monitoring Enstore on the Web*) to find the library manager of interest. Syntax:

```
% enstore library [--option [argument] ... ] <library>
```

The **<library>** argument is required except when using the **--help** option; the "**.library_manager**" portion of the library name is optional. Options:

-h, --help
Prints this message (i.e., prints the options). Example:

```
$ enstore library --help
```

```
Usage:
       library [OPTIONS]... library


          --get-asserts <library> print sorted lists of pending
volume asserts
         --get-queue <HOST_NAME>  print queue submitted from the
specified host.
                                  If empty string specified, print the
whole queue
       --get-suspect-vols    print suspect volume list
         --get-work-sorted      print sorted lists of pending and
active requests
   -h, --help                prints this messge
       --usage               prints short help message
```

--get-asserts <LIBRARY>
Prints sorted lists of pending volume asserts for specified library. Example:

```
$ enstore library --get-asserts
  9940.library_manager
```

```
Pending assert requests: 0
Active assert requests: 0
{'status': ('ok', None)}
```

--get-queue <HOST_NAME> <LIBRARY>
Prints queue submitted from the specified **encp** client host. Both arguments are required. If quoted empty string is specified for host name, it prints the whole queue (for all hosts). Examples:

```
$ enstore library --get-queue stkensrv3
  9940.library_manager

    Pending write requests
    Active requests
    Pending read requests:  0
    Pending write requests:  2
    Active read requests:  0
    Active write requests:  0
    {'status': ('ok', None)}
```

The top two lines tell us that there are no pending or active transfers involving stkensrv3 for the 9940 library manager. The 4th line tells us there are 2 pending write requests for this library manager from hosts other than stkensrv3.
If all hosts are specified (the next example), the command returns the fields: host name, library manager, username (of **encp** request), input filename, and output filename for each pending and/or active request (3 shown here), and ends with a summary:

```
$ enstore library --get-queue ""
  9940.library_manager

    Active requests
    fnsimu2 9940.library_manager lixn
       /pnfs/btev/geant2003/xiaonan/dstar_xiaonan_1.evt.gz
       /scr/bphys6/lixn/dstar_xiaonan_1.evt.gz M 9944
    fsgi01 9940.library_manager rschultz
       /usr/bdms/rschultz/fl_066_uplsr7/fl_ed_066_uplsr7.ldhi
       /pnfs/BDMS/lens/fl_066_uplsr7/fl_ed_0663
    fnsfh 9940.library_manager minfarm
       /export/stage02_minos/C00040259_0000.tdaq.root
       /pnfs/minos/caldet_reco/tdaq_data/2002-09/C0004027
    Pending read requests:  0
    Pending write requests:  0
    Active read requests:  1
    Active write requests:  2
    {'status': ('ok', None)}
```

--get-suspect-vols <LIBRARY>
Prints suspect volume list for specified library manager. See 10.6.1 *Suspect Volumes*. Example:

```
$ enstore library --get-suspect-vols
  9940.library_manager

    [{'movers': ['994071.mover'], 'external_label': 'VO4523',
```

```
'time':     1067290586.907726},     {'movers':     ['994051.mover',
'994061.mover', ']
```

--get-work-sorted <LIBRARY>
Prints sorted lists of pending and active requests. It sorts by queue. Example:

```
$ enstore library --get-work-sorted
  9940.library_manager

  {'write_queue': [], 'read_queue': [], 'admin_queue': []}
  [{'status': ('ok', None), 'vc': {'status': ('ok', None),
  'declared':  1011741604.130481,  'si_time':  [1041612783.99499,  0],
  'blocksiz]
```

2.3 enstore monitor

This command communicates with the Monitor Server (see Chapter 10: *Monitoring Enstore on the Web*) to get network speed information.
On machines with an `enstore.conf` file (see Appendix A: *Network Control*), the **`enstore monitor`** command uses the routing already established there. If **`enstore monitor`** set up its own, it would interfere with the routes currently in use.
Syntax:

```
% enstore monitor [--option [argument] ...]
```

-h, --help
Prints this message (i.e., prints the options). Example:

```
$ enstore monitor -h
Usage:
       monitor [ -h --help --host= --usage --verbose= ]

   -h, --help               prints this messge
       --host <HOSTIP>      selects a single host
       --port <PORT>        selects a port
       --usage              prints short help message
       --verbose <VERBOSE>  print out information.
```

--host [HOST_NAME or IP_ADDRESS]
Returns network rate for the specified host (Enstore node). If you don't specify host, it runs the command for all hosts. Example below shows results for a single host. Example:

```
$ enstore monitor --host stkensrv3

    Trying stkensrv3.fnal.gov
    Network rate measured at 11.33 MB/S recieving and 11.1 MB/S
    sending.
```

--port <PORT>
Selects the specified port. If you don't specify port, it runs the command for the default port.

--verbose <INTEGER_VALUE>
This command is used to help find and fix network problems. It prints detailed information about actions taken. The higher the number you give as an argument, the more info displayed. Example:

```
$ enstore monitor --host stkensrv3 --verbose 20

    6 Tue Oct 28 10:48:13 2003 msc called with args: ['monitor', '--
    host', 'stkensrv3', '--verbose=20']
    13 Tue Oct 28 10:48:13 2003 Get monitor_server config info from
    server
    Trying stkensrv0.fnal.gov
    13 Tue Oct 28 10:48:13 2003 Get None config info from server
    13 Tue Oct 28 10:48:13 2003 Get None config info from server
    13 Tue Oct 28 10:48:13 2003 Get log_server config info from server
    13 Tue Oct 28 10:48:13 2003 Get log_server config info from server
    13 Tue Oct 28 10:48:13 2003 Get None config info from server
    13 Tue Oct 28 10:48:13 2003 Get alarm_server config info from
    server
    ...
    10 Tue Oct 28 10:48:14 2003 Connecting to monitor server.
    10 Tue Oct 28 10:48:14 2003 Obtaining error status for data socket.
    10 Tue Oct 28 10:48:15 2003 Get the final dialog rate information.
    Network rate measured at 11.34 MB/S recieving and 11.23 MB/S
    sending.
```

2.4 enstore pnfs

Enstore has a **pnfs** command that allows you to retrieve a variety of information, as listed in the option table below. Off-site users cannot mount `/pnfs`, and therefore cannot run this command.

☞ Using this command to perform PNFS manipulations and/or change PNFS tags is restricted to Enstore administrators and/or their designated gurus, and is covered in Appendix B: *Changing PNFS Tags*.

Syntax:

% enstore pnfs [--option [argument] ...]

--help
List the options for the **enstore pnfs** command. Example:

% enstore pnfs --help

```
Usage:
       pnfs [OPTIONS]...

       --bfid <FILENAME>     lists the bit file id for file
       --cat <FILENAME> [LAYER]  see --layer
       --file-family [FILE_FAMILY]  gets file family tag, default; sets
file
                             family tag, optional
        --file-family-width [FILE_FAMILY_WIDTH]  gets file family width
tag,
                             default; sets file family tag, optional
         --file-family-wrapper [FILE_FAMILY_WRAPPER]  gets file family
width tag,
                             default; sets file family tag, optional
       --filesize <FILE>     print out real filesize
   -h, --help                prints this messge
       --info <FILENAME>     see --xref
       --layer <FILENAME> [LAYER]  lists the layer of the file
        --library [LIBRARY]   gets library tag, default; sets library
tag,
                             optional
       --tag <TAG> [DIRECTORY]  lists the tag of the directory
       --tagchmod <PERMISSIONS> <TAG>  changes the permissions for the
tag; use
                             UNIX chmod style permissions
        --tagchown <OWNER> <TAG>  changes the ownership for the tag;
OWNER can
                             be 'owner' or 'owner.group'
       --tags [DIRECTORY]    lists tag values and permissions
       --usage               prints short help message
       --xref <FILENAME>     lists the cross reference data for file
```

--bfid <FILE_NAME>
Returns the BFID of the file; select file name to specify from within pnfs space and use relative/absolute path as needed.
Example:

$ enstore pnfs --bfid /pnfs/mist/zuu/100MB_002

```
WAMS104102942800000
```

--cat <PATH_TO_FILE> [LAYER]
--cat is an alias for --layer; see --layer.

--file-family
Prints the file family name associated with the current pnfs directory. Example:

```
$ enstore pnfs --file-family
    dcache
```

--file-family-width
Prints the file family width associated with the current pnfs directory. Example:

```
$ enstore pnfs --file-family-width
    1
```

--file-family-wrapper
Prints the file family wrapper associated with the current pnfs directory. Example:

```
$ enstore pnfs --file-family-wrapper
    cpio_odc
```

--filesize <PATH_TO_FILE>
Prints the real filesize in bytes; useful for files of size greater than (2G-1) bytes, since PNFS stores file size as 1 in this case. Example:

```
$ enstore pnfs --filesize a01
    24198
```

--info <PATH_TO_FILE>
Prints information about the file, this is an alias for the --xref option. See --xref.

--layer <PATH-TO-FILE> <LAYER>
Prints information about the file. Layer 0 is used internally by pnfs and it can't be viewed. Layer 1, the default, gives the file's BFID. Layer 2 is used by dCache. Layers 3, 5, 6, 7 are not currently used. Layer 4 produces output equivalent to --xref, but returns info without field labels.
The option --cat is an alias for this option.
Examples:
Layer 1 gives BFID (default):

```
$ enstore pnfs --layer a01
    CDMS105889726300000
$ enstore pnfs --layer a01 1
    CDMS105889726300000
```

Layer 2 is used for dCache:

```
$ enstore pnfs --layer a01 2
    2,0,0,0.0,0.0
    :c=1:d15ef6a3;l=554423;
    w-fcdfdata018-1
```

The file has a version1 crc of c=1:d15ef6a3, it has a length l=554423, and it is in pool w-fcdfdata018-1.

```
$ enstore pnfs --layer a01 2
    2,0,0,0.0,0.0
    :
```

Layer 4 gives --xref output (see --xref):

```
$ enstore pnfs --layer a01 4
    VO3222
    0000_000000000_0006264
    24198
    dcache
    /pnfs/fs/usr/test/xyz/srmtest/test_1_1/a01

    000500000000000000191030

    CDMS105889726300000
    stkenmvr5a:/dev/rmt/tps3d1n:4560000022
```

--tags [DIRECTORY]
List the tag values of specified PNFS directory (if no directory argument, it lists tags for current working directory (cwd or pwd)).
Example:

```
$ pwd
    /pnfs/test/xyz/srmtest/test_1_1
$ enstore pnfs --tags
    .(tag)(file_family) = dcache
    .(tag)(file_family_width) = 1
    .(tag)(file_family_wrapper) = cpio_odc
    .(tag)(library) = 9940
    .(tag)(storage_group) = test
    -rw-rw-r--   11 root     sys            6 Jul 26  2001
                     /pnfs/test/xyz/srmtest/test_1_1/.(tag)(file_family)
    -rw-rw-r--   11 root     sys            1 May  5  2000
                                    /pnfs/test/xyz/srmtest/test_1_1/.(tag)
    (file_family_width)
    -rw-rw-r--   11 root     sys            8 May  5  2000
                                    /pnfs/test/xyz/srmtest/test_1_1/.(tag)
    (file_family_wrapper)
    -rw-rw-r--   11 root     sys            4 Jul  3 10:59
                     /pnfs/test/xyz/srmtest/test_1_1/.(tag)(library)
    -rw-r--r--   11 root     sys            4 Jul 26  2001
                     /pnfs/test/xyz/srmtest/test_1_1/.(tag)(storage_group)
```

(minor reformatting done to enhance readability)

--xref <FILE_NAME>
List cross-reference information (metadata) for specified file. (--info is an alias for --xref.) The information includes:

- volume: storage media volume label
- location cookie: file position on tape (the number of the file on tape)
- size: file size in bytes
- file family: file family
- original name: original name in `/pnfs` before any move/copy command issued; i.e., the destination filename given in the **`encp`** command used to copy the file to Enstore
- map file: obsolete, but some older files may have a value here
- pnfsid file: unique id for the file as assigned by PNFS
- pnfsid map: obsolete, but some older files may have a value here
- bfid: unique id for the file as assigned by Enstore (matches layer 1)
- origdrive: id of drive used when file was written to media (files generated prior to 10/2000, **encp** v2_5 or earlier, will not have a value here)
- crc: CRC of the file (appears for files after 10/2003, using **encp** v3_1 or greater)

Example:

```
$ enstore pnfs --xref a01

    volume: VO3222
    location_cookie: 0000_000000000_0006264
    size: 24198
    file_family: dcache
    original_name: /pnfs/fs/usr/test/xyz/srmtest/test_1_1/a01
    map_file:
    pnfsid_file: 000500000000000000191030
    pnfsid_map:
    bfid: CDMS105889726300000
    origdrive: stkenmvr5a:/dev/rmt/tps3d1n:4560000022
    crc: unknown
```

--library
Returns the value of the library tag (the virtual library associated with files in the directory) for the current pnfs directory. Example:

```
$ enstore pnfs --library

    9940
```

2.5 enstore file (deprecated)

This command has been deprecated for users as of **encp** v3_2, and (along with **`enstore volume`**) replaced with **`enstore info`** (see section Error: Reference source not found).

This command communicates with the File Clerk (see section 8.1 *File Clerk*). It returns information about a specified file or files on a specified volume.

Syntax:

```
% enstore file [--option [argument] ... ]
```

Options:

-h, --help
Prints the options (i.e., prints this message). Example:

```
$ enstore file --help
    Usage:
           file [ -h --bfid= --help --list= --ls-active= --usage ]

           --bfid <BFID>         get info of a file
       -h, --help                print this message
           --list <VOLUME_NAME>  list the files in a volume
           --ls-active <VOLUME_NAME>  list active files in a volume
           --show-bad            lists all bad files
           --usage               print short help message
```

--bfid <BFID>
Returns information (metadata) about the file corresponding to the specified bfid.
You can get the bfid of a file from the **`enstore pnfs --bfid <FILE_NAME>`** command (section Error: Reference source not found); get the filename from searching PNFS namespace.
Example:

```
$ enstore file --bfid CDMS105770745000000
    {'bfid': 'CDMS105770745000000',
     'complete_crc': 1191066979L,
     'deleted': 'no',
     'drive': 'stkenmvr7a:/dev/rmt/tps0d1n:4560000022',
     'external_label': 'VO3222',
     'location_cookie': '0000_000000000_0005661',
     'pnfs_mapname': '',
                                                        'pnfs_name0':
    '/pnfs/fs/usr/test/xyz/srmtest/ar017983.0001phys_10',
     'pnfsid': '000500000000000000190EA8',
     'pnfsvid': '',
```

```
 'sanity_cookie': (65536L, 3203712884L),
 'size': 197354833L}
```

--list <VOLUME_NAME>
Lists the files in the specified volume with their volume name, bfid, size, location (file number) on volume, delete flag, and the original filename in pnfs.
You can get the volume name from the **`enstore pnfs`** command, using either **`--xref`** or **`--layer`** (section Error: Reference source not found), or from the "external_label" field of the **`enstore file --bfid <BFID>`** command (shown above).
The **`enstore info --list <VOLUME_NAME>`** is an alias for this command.
Example:

```
$ enstore file --list VO3222
    label  bfid               size   location_cookie        delflag
    original_name

    VO3222 CDMS106503213600000 983803 0000_000000000_0011536 deleted
    /pnfs/fs/usr/eagle/dcache-tests/274.dcache_page_p_27750
```

(This shows one of many lines appearing in the real output, and is reformatted to two lines for readability.)

--ls-active <VOLUME_NAME>
Lists active files in a volume.
You can get the volume name from the **`enstore pnfs`** command, using either **`--xref`** or **`--layer`** (section Error: Reference source not found), or from the "external_label" field of the **`enstore file --bfid <BFID>`** command (shown above).
Example:

```
$ enstore file --ls-active VO3222

    /pnfs/fs/usr/eagle/dcache-tests/101.dcache_page_a_24401
    /pnfs/fs/usr/eagle/dcache-tests/101.dcache_page_24401
    /pnfs/fs/usr/test/stress-test/myfile1
    /pnfs/fs/usr/test/stress-test/myfile3
    /pnfs/fs/usr/test/stress-test/file128m-11
    ...
```

--show-bad
Lists all files that are currently unavailable due to media problems. When a tape problem is discovered, the tape is sent to the vendor for file recovery. In the interim, a cloned tape is made available to users, with the bad files marked. This command option lets you list the bad files. The output lists the tape number, BFID, file size in bites, and pnfs path of file.
Example:

```
$ enstore info --show-bad

    ...
    VO0053 CDMS105770745000000 95530315
     /pnfs/fs/usr/xyz/my_data/2004-4/.bad.F000xyz43_0000.mdaq.root
    ...
```

We show only one output line, and it is displayed on two lines for readability. Notice the "`.bad.`" at the front of the filename; this is how the bad files are marked.
Replaced by: **`enstore info --show-bad`**.

--usage
Prints short help message. Example:

```
$ enstore file --usage

    Usage:
           file [ -h --bfid= --help --list= --ls-active= --usage ]
```

-h, --help
Prints this message (i.e., prints the options). Example:

$ enstore volume --help

```
Usage:
       volume [OPTIONS]...


           --gvol <VOLUME_NAME>   get info of a volume in human
readable time
                                  format
   -h, --help                     prints this messge
       --just <VOLUME_NAME>  used with --pvols to list problem
       --list <VOLUME_NAME>  list the files in a volume
       --ls-active <VOLUME_NAME>  list active files in a volume
       --ls-sg-count         list all sg counts
       --pvols               list all problem volumes
       --usage               prints short help message
       --vol <VOLUME_NAME>   get info of a volume
       --vols                list all volumes
```

--gvol <VOLUME_NAME>
This is just like **enstore volume --vol <VOLUME_NAME>**, except that this one prints human-readable time fields (e.g., “declared”, “first_access” and “last_access” fields). Example:

$ enstore volume --gvol VO3332

```
{'blocksize': 131072,
 'capacity_bytes': 64424509440L,
 'declared': 'Wed Jan 16 16:13:57 2002',
 'eod_cookie': '0000_000000000_0000044',
 'external_label': 'VO3332',
 'first_access': 'Fri May 10 12:59:35 2002',
 'last_access': 'Mon Oct 27 22:35:45 2003',
 'library': '9940',
 'media_type': '9940',
 'non_del_files': 43,
 'remaining_bytes': 1785262080L,
 'sum_mounts': 234,
 'sum_rd_access': 213,
 'sum_rd_err': 0,
 'sum_wr_access': 43,
 'sum_wr_err': 0,
 'system_inhibit': ['none', 'full'],
 'user_inhibit': ['none', 'none'],
 'volume_family': 'cms.objy_data_files.cpio_odc',
 'wrapper': 'cpio_odc'}
```

--just
Used with **`--pvols`** to list problem. See **`enstore volume --pvols`**.

--list <VOLUME_NAME>
This is an alias for the **`enstore info --list <VOLUME_NAME>`** command. See section Error: Reference source not found.

--ls-active <VOLUME_NAME>
Lists original file names of active files in a volume. Example:

```
$ enstore volume --ls-active VO3332

/
pnfs/cms/UserFederation/data/jetmet_production/data/Collections/jm
_Hit601_g125_UCSD/jm02_qqh120_ll/EVD0.jet0102.DB
/
pnfs/cms/UserFederation/data/jetmet_production/data/TAssoc/jm_2x10
33PUjm602_TkMu_g125_UCSD/jm02_hlt15-20/EVD11.jet0102.DB
/
pnfs/cms/UserFederation/data/jetmet_production/data/Digis/jm_2x103
3PUjm602_TkMu_g125_UCSD/jm02-hlt0-15/EVD12.jet0102.DB
/
pnfs/cms/UserFederation/data/jetmet_production/data/Hits/jm_Hit601
_g125_UCSD/jm02_hlt230-300/EVD12.jet0102.DB
...
```

--ls-sg-count <VOLUME_NAME>
Lists allocated tape counts by library and by storage group. If "storage group" has value "none", the negative number under "allocated" gives the number of tapes that are available in the robot, but not yet assigned to a storage group.
Example:

```
$ enstore volume --ls-sg-count VO3332

     library    storage group  allocated
=========================================
       ...
       9940             ktev        189
       9940             lqcd        150
       9940        miniboone        132
       9940            minos        109
       9940             none        -13
       9940          patriot         20
       9940             sdss        608
       9940             test         28
       9940           theory         70
   CD-9940B              cms        129
       ...
```

--pvols [--just <VOLUME_1> <VOLUME_2> ...]
Without **`--just`**, this lists all problem volumes. With **`--just`** followed by a space-separated list of volume names, it lists only the problem volumes among the given list.
The columns returned are: volume name, primary status, primary status time, secondary status, secondary status time. (The time fields are relatively new; not all volumes will display them.)
Example:

`$ enstore volume --pvols`

```
==== readonly
LEGL10             none         *     readonly 0913-1540
LEGL98             none         *     readonly 0819-2329
...
==== full
...
VO4845             none         *         full         *
VO4846             none 1023-1032         full         *
VO4847             none         *         full         *
VO4848             none         *         full         *
VO4849             none         *         full         *
VO4850             none         *         full 1016-2315
VO4851             none         *         full 1017-0409
...
$ enstore volume --pvols --just VO3332
(no sample output available)
```

--vol <VOLUME_NAME>
Returns detailed information about specified volume
Example:

```
$ enstore volume --vol VO3332
```

```
{'blocksize': 131072,
 'capacity_bytes': 64424509440L,
 'declared': 1011219237.849051,
 'eod_cookie': '0000_000000000_0000044',
 'external_label': 'VO3332',
 'first_access': 1021053575.259737,
 'last_access': 1067315745.238969,
 'library': '9940',
 'media_type': '9940',
 'non_del_files': 43,
 'remaining_bytes': 1785262080L,
 'sum_mounts': 234,
 'sum_rd_access': 213,
 'sum_rd_err': 0,
 'sum_wr_access': 43,
 'sum_wr_err': 0,
 'system_inhibit': ['none', 'full'],
 'user_inhibit': ['none', 'none'],
 'volume_family': 'cms.objy_data_files.cpio_odc',
 'wrapper': 'cpio_odc'}
```

--vols
Lists all volumes with their available space, the system inhibits, the library, the volume family (period-separated concatenation of storage group, file family and file family wrapper) and any comments.
Example:

```
$ enstore volume --vols
```

```
label          avail.    system_inhibit      library    vol_family
comment
...
VO0053            1.19GB      (none      full   )            eagle
cms.objy_data_files.cpio_odc
VO0054            0.51GB      (none      full   )            eagle
cms.objy_data_files.cpio_odc
VO0055    0.17GB  (none  full )    eagle    theory.theory-canopy-
C.cpio_odc
VO0056    0.65GB  (none  full )    eagle    theory.theory-canopy-
D.cpio_odc
...
```

Chapter 3: Enstore Administrator Commands

Enstore provides commands that allow you to communicate with various components of the system. The basic syntax of all Enstore commands is
`% enstore <command> [--option [argument] ...]`
All options start with a double dash (--). The return codes are 0 (zero) for success, non-zero for failure (currently all failures return number 1.)
The switches listed here are additional to those defined in the "The Enstore and dCache User's Guide."

3.1 enstore alarm

Syntax:
`% enstore configuration [ --option [argument] ...]`
Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

```
$ enstore configuration --help
Usage:
       alarm [OPTIONS]...

   -a, --alive              prints message if the server is up or down.
       --client-name <CLIENT_NAME>  set alarm client name
       --condition <CONDITION>  condition used when generating a remedy ticket
       --do-alarm <DO_ALARM>  turns on more alarms
       --do-log <DO_LOG>     turns on more verbose logging
       --do-print <DO_PRINT>  turns on more verbose output
       --dont-alarm <DONT_ALARM>  turns off more alarms
       --dont-log <DONT_LOG>  turns off more verbose logging
       --dont-print <DONT_PRINT>  turns off more verbose output
       --dump                print (stdout) alarms the alarm server has in
                             memory
   -h, --help                prints this messge
       --message <MESSAGE>   message along with raise option
       --raise               raise an alarm
       --remedy_type <REMEDY_TYPE>  type used when generating a remedy ticket
       --resolve <KEY>       resolve the previously raised alarm whose key
                             matches the entered value
       --retries <ALIVE_RETRIES>  number of attempts to resend alive requests
       --root-error <ROOT_ERROR>  error which caused an alarm to be raised [D:
                             UNKONWN]
       --severity <SEVERITY>  severity of raised alarm (E, U, W, I, M, C)[D:
W]
       --timeout <SECONDS>   number of seconds to wait for alive response
       --usage               prints short help message
```

--client-name
When issuing an alarm from the command line this switch allows the user to specify the name of the client. This overrides the default of "ALARM_CLIENT."

--dump
Dump the current list of alarms. This output goes to the file that stdout has been redirected to for the alarm_server; not the stdout for the alarm_server client.

```
$ enstore alarm --dump
```

--message <MESSAGE>
Include the message in the alarm. This is intended to be the long description of the problem. Used with --raise.
See --raise for an example.

--remedy-type <REMEDY_TYPE>
This is an FNAL specific switch. Possible values are:

- 'STK Enstore'
- 'D0 Enstore'
- 'CDF Enstore'

for the remedy category MSS.

--rasise
Raise an alarm from the command line. See --message, --root-error and --severity.

```
$ enstore alarm --raise --severity E --root-error \
“permission denied” --message \
“Unable to query tape robot via media changer stk.”
```

--resolve <KEY>
Remove the alarm with key KEY from the Enstore Active Alarms web page. The key can be obtained from the Enstore Active Alarms web page or from --dump.

```
$ enstore alarm --resolve 1044893163.67
```

--root-error <ROOT_ERROR>
Include text that gives the reason for the error. This is intended to be a short string. Used with --rasise. The default string is “UNKNOWN.”
See --raise for an example.

--severity <SEVERITY>
The severity needs to be one of the following letters:

7. E - Error.
8. U – User Error.
9. W – Warning. This is the default.
10. I – Informational. Use of this severity is discouraged. Alarms are supposed to indicate real problems.
11. M – Miscellaneous. Use of this severity is discouraged. Alarms are supposed to indicate real problems.
12. C – E-mailable error. Some errors are only resolvable by the administrators of the client machines (typically those that run encp). This option will send them the alarm via e-mail. See the alarm server configuration section 1.4.1 for configuration. If the error cannot be e-mailed it defaults to placing it on the alarms page.

3.2 enstore backup

This command initiates the backup of the Enstore Database. The backup is dumped into the directory specified in the configuration file in `database|db_dir` and copied to the backup host defined in `crons|backup_node` to the backup directory defined in `crons|backup_dir`.
Syntax:

```
% enstore backup
```

3.3 enstore configuration

Syntax:

```
% enstore configuration [ --option [argument] ...]
```

Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

$ enstore configuration --help

```
Usage:
       conf [OPTIONS]...

   -a, --alive               prints message if the server is up or down.
       --config-file <CONFIG_FILE>  config file to load
       --do-alarm <DO_ALARM>  turns on more alarms
       --do-log <DO_LOG>     turns on more verbose logging
       --do-print <DO_PRINT>  turns on more verbose output
       --dont-alarm <DONT_ALARM>  turns off more alarms
       --dont-log <DONT_LOG>  turns off more verbose logging
       --dont-print <DONT_PRINT>  turns off more verbose output
       --file-fallback       return configuration from file if configuration
                             server is down
   -h, --help                prints this messge
       --list-library-managers  list all library managers in configuration
       --list-media-changers  list all media changers in configuration
       --list-movers         list all movers in configuration
       --load                load a new configuration
       --print               print the current configuration
       --retries <ALIVE_RETRIES>  number of attempts to resend alive requests
       --show                print the current configuration in python format
       --summary             summary for saag
       --threaded-impl <THREADED_IMPL>  Turn on / off threaded implementation
       --timeout <SECONDS>   number of seconds to wait for alive response
       --timestamp           last time configfile was reloaded
       --usage               prints short help message
```

--config-file <CONFIG_FILE>
Used with –load to tell the configuration server the configuration file to load. For an example see --load.

--file-fallback
If the configuration server is not available (by default after 9 seconds), then the configuration client will return the contents of the configuration file located in the $ENSTORE_CONFIG_FILE environmental variable. Use --retries and--timeout to override the 9 second default. This switch is expected to be used by Enstore installation scripts that may need to be run before Enstore is started.
Must be used with either --show or --print.

$ enstore configuration --file-fallback --show crons html_dir

```
    /srv/enstore/www
```

--list-library-managers
Output to standard out the list of all configured library managers.

$ enstore configuration --list-library-managers

```
            library manager            host
       9940.library_manager stkensrv4.fnal.gov
        dlt.library_manager stkensrv4.fnal.gov
       test.library_manager stkensrv4.fnal.gov
      null1.library_manager stkensrv4.fnal.gov
   CD-9940B.library_manager stkensrv4.fnal.gov
CD-LTO3_test.library_manager stkensrv4.fnal.gov
    CD-LTO3.library_manager stkensrv3.fnal.gov
```

--list-media-changers
Output to standard out the list of all configured media changers.

$ enstore configuration --list-media-changers

```
            media changer            host                type
      null1.media_changer stkensrv4.fnal.gov      RDD_MediaLoader
     SL8500.media_changer stkensrv4.fnal.gov      STK_MediaLoader
        stk.media_changer stkensrv4.fnal.gov      STK_MediaLoader
```

--list-movers
Output to standard out the list of all configured movers.

$ enstore configuration --list-movers

```
          mover            host mc_device     driver         library
  9940B27.mover     stkenmvr27a  0,1,10,2  FTTDriver CD-9940B.library_manager
  9940B40.mover     stkenmvr40a  0,1,10,7  FTTDriver CD-9940B.library_manager
  LTO3_13.mover    stkenmvr113a  0,3,1,12  FTTDriver CD-LTO3.library_manager
  LTO3_06.mover    stkenmvr106a   0,0,1,3  FTTDriver CD-LTO3.library_manager
  9940B16.mover     stkenmvr16a 0,0,10,18  FTTDriver CD-9940B.library_manager
  LTO3_14.mover    stkenmvr114a  0,3,1,13  FTTDriver CD-LTO3.library_manager
  9940B26.mover     stkenmvr26a  0,0,10,7  FTTDriver CD-9940B.library_manager
  9940B11.mover     stkenmvr11a 0,0,10,16  FTTDriver CD-9940B.library_manager
  9940B21.mover     stkenmvr21a  0,1,10,4  FTTDriver CD-9940B.library_manager
   994052.mover      stkenmvr5a  0,0,10,9  FTTDriver 9940.library_manager
  LTO3_12.mover    stkenmvr112a   0,1,1,1  FTTDriver CD-LTO3.library_manager
  LTO3_08.mover    stkenmvr108a  0,2,1,13  FTTDriver ['CD-
LTO3.library_manager', 'CD-LTO3_test.library_manager']
```

--load
Tell the configuration server to reload the configuration file.

**$ enstore configuration --load –config-file **
$ENSTORE_CONFIG_FILE

--print
Output to standard out the current Enstore configuration in a script friendly format. If one or more KEYs are present then just that subsection of the configuration is printed. See--show for a different output format. Example:

$ enstore conf --print crons html_dir

```
crons.html_dir:/local/ups/prd/www_pages/enstore/
```

--show [KEY1 [KEY2] ...]]
Output to standard out the current Enstore configuration in a native python format. If one or more KEYs are present then just that subsection of the configuration is printed. See--show for a different output format. Example:

$ enstore conf --show blocksizes

```
{'8MM': 131072,
 '9840': 131072,
 '9940': 131072,
 '9940B': 131072,
 'DECDLT': 131072,
 'LTO3': 131072,
 'null': 131072,
 'status': ('ok', None)}
```

--threaded-impl <THREADED_IMPL>
Parts of the configuration server have been made multi threaded for performance reasons. Early on this proved to be unstable. THREADED_IMPL should be set to 1 (default) for turning on the threading or 0 for turning it off.

```
$ enstore configuration --threaded-impl 1
```

--timestamp
Displays the date and time that the configuration was las (re)loaded into the configuration server.

```
$ enstore configuration --timestamp
Thu Jan 10 17:43:25 2008
```

3.4 enstore event_relay

Syntax:

```
% enstore event_relay [--options [arguments] ...]
```

Options:

--dump
Tells the event_relay to dump to contents of the list of processes that have subscribed for event_relay messages. This output goes to the file that stdout has been redirected to for the event_relay; not the stdout for the event_relay client.

```
$ enstore event_relay --dump
```

3.5 enstore file

Syntax:

```
% enstore file [--options [arguments] ...]
```

Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

$ enstore file --help

```
Usage:
       file [OPTIONS]...

       --add <BFID>          add file record (dangerous! don't try this at
                             home)
   -a, --alive               prints message if the server is up or down.
       --backup              backup file journal -- part of database backup
       --bfid <BFID>         get info of a file
       --bfids <VOLUME_NAME>  list all bfids on a volume
       --deleted <YES/NO>    used with --bfid to mark the file as deleted
       --do-alarm <DO_ALARM>  turns on more alarms
       --do-log <DO_LOG>     turns on more verbose logging
       --do-print <DO_PRINT>  turns on more verbose output
       --dont-alarm <DONT_ALARM>  turns off more alarms
       --dont-log <DONT_LOG>  turns off more verbose logging
       --dont-print <DONT_PRINT>  turns off more verbose output
       --find-all-copies <FILE>  find all copies of this file
       --find-copies <FILE>  find the immediate copies of this file
       --find-duplicates <FILE>  find all duplicates related to this file
       --find-original <FILE>  find the immediate original of this file
       --find-the-original <FILE>  find the very first original of this file
       --get-crcs <BFID>     get crc of a file
   -h, --help                prints this messge
       --list <VOLUME_NAME>  list the files in a volume
       --ls-active <VOLUME_NAME>  list active files in a volume
       --mark-bad <PATH> [BFID] Mark the file with the given filename as bad.
                             Include the bfid only if the file is a multiple
                             copy file.
       --modify <BFID>       modify file record (dangerous!)
       --recursive           restore directory
       --restore <BFID> [UID[:GID]]  restore a deleted file with optional
                             uid:gid
       --retries <ALIVE_RETRIES>  number of attempts to resend alive requests
       --set-crcs <SET_CRCS>  set CRC of a file
       --show-bad            list all bad files
       --show-state          show internal state of the server
       --timeout <SECONDS>   number of seconds to wait for alive response
       --unmark-bad <PATH> [BFID]  Unmark the file with the given filename as
                             bad.  Include the bfid only if the file is a
                             multiple copy file.
       --usage               prints short help message
```

--add <BFID> <key1>=<value1> <key2>=<value2> ...
Add file record to the Enstore DB. <BFID> must fit the bfid string pattern. If <BFID> is “None”, then a new bfid will be assigned. The bfid is always printed to the terminal; this is important for the cases where a new bfid is assigned. If the bfid you want already exists use `--modify` instead. There is no normal use case for this switch.

**$ enstore file --add None pnfs_name0=/pnfs/blah complete_crc=1 size=42 **
**pnfsid=000D000000000023 deleted=y drive= external_label=TEST00 **
location_cookie=0000_00000000_000001 "sanity_cookie=(42,1)"

```
bfid = WAMS121457893800000
```

To confirm that everything is accurate:

$ enstore file --bfid WAMS121457893800000

```
{'bfid': 'WAMS121457893800000',
 'complete_crc': 1L,
 'deleted': 'yes',
 'drive': '',
 'external_label': 'TEST01',
 'gid': -1,
 'location_cookie': '0000_00000000_000001',
 'pnfs_name0': '/pnfs/mist/blah',
 'pnfsid': '000D000000000023',
 'sanity_cookie': (42L, 1L),
 'size': 42L,
 'uid': -1,
 'update': None}
```

Note: The fields shone in this example are the required fields. The `gid` and `uid` fields are defaulted to -1 in this case.
Note: It is important to make sure that the volume is defined in Enstore before using this command. If the volume does not exist, then commands like “`enstore info --bfid <bfid>`” will fail with “NO SUCH FILE/BFID” because of the use of outer joins between the file and volume tables. This also means that `--modify` will not work, requiring this to be fixed at the SQL level.

--backup
Backup the file journal.

`$ enstore file --backup`

--bfids <VOLUME_NAME>
Deprecated. See **enstore info--bfids** . This file command has been modified to point to the information server instead of the file clerk.

--deleted <yes | no>
Used with --bfid to mark a file as deleted.

```
$ enstore info --bfid WAMS118954675400000 | grep deleted
 'deleted': 'no',
$ enstore file --bfid WAMS118954675400000 --deleted yes

$ enstore info --bfid WAMS118954675400000 | grep deleted
 'deleted': 'yes',
```

--find-all-copies <BFID>
List all the BFIDs that are multiple copies or originals of the specified BFID.

```
$ enstore file --find-all-copies WAMS115254898100000
WAMS115254898100000
WAMS115254898700000
```

--find-copies <BFID>
List all the immediate copies of the specified BFID.

```
$ enstore file --find-copies WAMS115254898100000
WAMS115254898700000
$ enstore file --find-copies WAMS115254898700000
```

--find-duplicates <BFID>
List the original and all copies of the specified BFID.

```
$ enstore file --find-duplicates WAMS115254898700000
WAMS115254898100000
WAMS115254898700000
$ enstore file --find-duplicates WAMS115254898100000
WAMS115254898100000
WAMS115254898700000
```

--find-original <BFID>
List the immediate original to this BFID.

```
$ enstore file --find-original WAMS115254898700000
WAMS115254898100000
```

--find-the-original <BFID>
List the master original to this BFID.

```
$ enstore file --find-original WAMS115254898700000
WAMS115254898100000
```

--get-crcs <BFID>
Prints to standard out the crc information for the specified file.

```
$ enstore file --get-crcs WAMS115254898700000
bfid 'WAMS115254898700000': sanity_cookie (10241L, 1458501222L), complete_crc
1458501222L
```

--mark-bad <PATH> [BFID]
Renames the file specified by <PATH> in PNFS to be <DIRNAME>/.bad.<BASENAME>. This must be the current path in PNFS, and not the original path stored in the Enstore DB. The Enstore database is also updated to include a record that this file has been marked bad, but does not also modify the original path.

Files should be marked bad when the file has been determined to be unreadable from tape, but other files on the tape continue to read without problems. If there is a problem with reading every file on the tape or the tape itself then set the tape NOTALLOWED with the enstore volume--not-allowed command in section 1.24. See also--unmark-bad and --show-bad.

```
$ ls /pnfs/test/my_dir/1KB_147
/pnfs/test/NULL/1KB_147
# enstore file --mark-bad  /pnfs/test/my_dir/1KB_147

$ ls /pnfs/mist/my_dir/.bad.1KB_147
/pnfs/test/NULL/.bad.1KB_147
```

If the bad file is a multiple copy of the primary copy of the file, then we need to specify the multiple copy"s BFID on the command line.

```
# enstore file --mark-bad \
/pnfs/test/my_dir/1KB_147 CDMS121891419900000
```

--modify <BFID>
Modify the database entry for the specified BFID. This command can create many problems if not used with the utmost care. The quoting shown below is not always necessary, however there are some PNFS ids that happen to look like exponential numbers to python. The quoting shown overrides the default attempt to interpret them as floating point numbers and instead treats them as strings.

```
$ enstore file --bfid WAMS100888634200000
{'bfid': 'WAMS100888634200000',
 'complete_crc': 0L,
 'deleted': 'no',
 'drive': 'rain:/dev/null:0',
 'external_label': 'NULL01',
 'gid': -1,
 'location_cookie': '0000_000000000_0000142',
 'pnfs_name0': '/pnfs/mist/NULL/1KB_100',
 'pnfsid': '000100000000000000006350',
 'sanity_cookie': (1024L, 0L),
 'size': 1024L,
 'uid': -1,
 'update': None}
$ enstore file --modify WAMS100888634200000 "gid=1530" \
 "uid=9276" "pnfsid='000100000000000000006350'"
bfid = WAMS100888634200000
$ enstore file --bfid WAMS100888634200000
{'bfid': 'WAMS100888634200000',
 'complete_crc': 0L,
 'deleted': 'no',
 'drive': 'testnode:/dev/null:0',
 'external_label': 'NULL01',
 'gid': 1530,
 'location_cookie': '0000_000000000_0000142',
 'pnfs_name0': '/pnfs/test/NULL/1KB_100',
 'pnfsid': '000100000000000000006350',
 'sanity_cookie': (1024L, 0L),
 'size': 1024L,
 'uid': 9276,
 'update': None}
```

--recursive

--restore <BFID> [UID[:GID]]
This command will restore a file that has been removed from PNFS and has been marked as deleted in the Enstore database. PNFS must be mounted and the current effective user id must have the necessary permissions to touch/open the file in the PNFS namespace. For all practical purposes, this command will almost always be run as user root on the PNFS server itself; though that is not a requirement.

```
$ enstore info --bfid WAMS120224553900000
{'bfid': 'WAMS120224553900000',
 'complete_crc': 0L,
 'deleted': 'yes',
 'drive': 'testnode:/dev/null:0',
 'external_label': 'NULL10',
 'gid': 1530,
 'location_cookie': '0000_000000000_0000005',
 'pnfs_name0': '/pnfs/test/NULL/restore_example_file',
 'pnfsid': '00010000000000000007FF08',
 'sanity_cookie': (12559L, 0L),
 'size': 12559L,
 'uid': 9276,
 'update': None}
$ ls /pnfs/test/NULL/restore_example_file
ls: /pnfs/test/NULL/restore_example_file: No such file or directory
$ enstore file --restore WAMS120224553900000

$ ls /pnfs/test/NULL/restore_example_file
/pnfs/test/NULL/restore_example_file
```

--set-crcs

--show-bad
List all files that are marked bad. See also--mark-bad and --unmark-bad.

```
$ enstore file --show-bad
NULL01 WAMS103661998200000 1024 /pnfs/test/NULL/.bad.1KB_147
```

--unmark-bad <PATH> [BFID]
Unmark a file that has previously been marked as bad. This renames the file in PNFS back to its original name and removes the file from the marked bad list in the Enstore database. See also--mark-bad and--show-bad.

```
$ ls /pnfs/test/my_dir/1KB_147
ls: /pnfs/test/NULL/1KB_147: No such file or directory
$ ls /pnfs/test/my_dir/.bad.1KB_147
/pnfs/test/NULL/.bad.1KB_147
```

It is important to note in the following example command that the basename of the file starts with .bad. and is not the original filename given to the --mark-bad command.

```
# enstore file --unmark-bad  /pnfs/test/my_dir/.bad.1KB_147

$ ls /pnfs/test/my_dir/1KB_147
/pnfs/test/NULL/1KB_147
```

If the bad file is a multiple copy of the primary copy of the file, then we need to specify the multiple copy's BFID on the command line.
For multiple copies, the path is not changed when the --mark-bad is done. Do not include the .bad. at the beginning of the file like primary files are done.

```
# enstore file --unmark-bad \
/pnfs/test/my_dir/1KB_147 CDMS121891419900000
```

3.6 enstore info

As of encp v3_2, the user level command `enstore info` supersedes `enstore file` and `enstore volume`. The admin level commands `enstore file` and `enstore volume` are still used for modifying commands.
Syntax:
`% enstore info [--option [argument] ...]`
Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

$ enstore file --help

```
Usage:
       info [OPTIONS]...

   -a, --alive               prints message if the server is up or down.
       --bfid <BFID>         get info of a file
       --bfids <VOLUME_NAME>  list all bfids on a volume
       --check <VOLUME_NAME>  check a volume
       --do-alarm <DO_ALARM>  turns on more alarms
       --do-log <DO_LOG>     turns on more verbose logging
       --do-print <DO_PRINT>  turns on more verbose output
       --dont-alarm <DONT_ALARM>  turns off more alarms
       --dont-log <DONT_LOG>  turns off more verbose logging
       --dont-print <DONT_PRINT>  turns off more verbose output
       --file <PATH|PNFSID|BFID|VOL:LOC>  get info of a file
       --find-all-copies <BFID>  find all copies of this file
       --find-copies <BFID>  find the immediate copies of this file
       --find-duplicates <BFID>  find all duplicates related to this file
       --find-original <BFID>  find the immediate original of this file
       --find-same-file <BFID>  find a file of the same size and crc
       --find-the-original <BFID>  find the very first original of this file
       --get-sg-count <LIBRARY> <STORAGE_GROUP>  check allocated count for
                                 lib,sg
       --gvol <VOLUME_NAME>  get info of a volume in human readable time
                                 format
   -h, --help                prints this messge
       --history <VOLUME_NAME>  show state change history of volume
       --just                used with --pvols to list problem
       --labels              list all volume labels
       --list <VOLUME_NAME>  list the files in a volume
       --ls-active <VOLUME_NAME>  list active files in a volume
       --ls-sg-count         list all sg counts
       --pvols               list all problem volumes
       --query <QUERY>       query database
       --retries <ALIVE_RETRIES>  number of attempts to resend alive requests
       --show-bad            list all bad files
       --show-copies <BFID>  all copies of a file
       --show-file <BFID>    show info of a file
       --timeout <SECONDS>   number of seconds to wait for alive response
       --usage               prints short help message
       --vol <VOLUME_NAME>   get info of a volume
       --vols                list all volumes
       --write-protect-status <VOLUME_NAME>  show write protect status
```

--bfids <VOLUME_NAME>
List all of the BFIDs on the specified volume.

$ enstore info --bfids TEST01

```
WAMS100456552800000
WAMS100456552900000
WAMS100456553000000
WAMS100456553100000
WAMS100456563700000
WAMS100463404700000
WAMS100463422700000
WAMS100463427300000
WAMS100463493300000
WAMS100463735500000
```

--check <VOLUME_NAME>
Prints a synopsis of the volume status.

$ enstore info --check TEST01

```
TEST01        0.52GB ['none', 'full'] ['none', 'none']
```

--find-same-file <BFID>
Lists all files in the Enstore DB with the same CRC and size as the file with the specified BFID.

$ enstore info --find-same-file WAMS115254898100000

```
TEST01  WAMS115401377100000    10241 0000_000000000_0000005 deleted
/pnfs/test/10KB_002
TEST01  WAMS115401417000000    10241 0000_000000000_0000007 deleted
/pnfs/test/10KB_002
TEST01  WAMS115254898100000    10241 0000_000000000_0000010 active
/pnfs/test/10KB_002
```

--get-sg-count <LIBRARY> <STORAGE_GROUP>
Lists the number of volumes belonging to the indicated library and storage group pairing.

$ enstore info --get-sg-count LTO3 test

```
       rain             zee         3
```

--gvol <VOLUME_NAME>
Same as --vol except that time values are displayed in human readable format. See also--vol.

$ enstore info --gvol TST001

```
{'blocksize': 131072,
 'capacity_bytes': 858993459200L,
 'comment': '',
 'declared': 'Fri Dec 21 14:31:20 2007',
 'eod_cookie': '0000_000000000_0000639',
 'external_label': 'TST001',
 'first_access': 'Fri Dec 21 16:03:09 2007',
 'last_access': 'Sun Jan 20 10:33:53 2008',
 'library': 'LTO4',
 'media_type': 'LTO4',
 'remaining_bytes': 719404544L,
 'si_time': ('Wed Dec 31 18:00:00 1969', 'Wed Dec 26 14:57:03 2007'),
 'sum_mounts': 369,
 'sum_rd_access': 707,
 'sum_rd_err': 1,
 'sum_wr_access': 638,
 'sum_wr_err': 0,
 'system_inhibit': ['none', 'full'],
 'user_inhibit': ['none', 'none'],
 'volume_family': 'SSA.ssa-test.cpio_odc',
 'wrapper': 'cpio_odc',
 'write_protected': 'n'}
```

--history <VOLUME_NAME>
Prints a report of the status changes to the volume.

$ enstore info --history TST001

```
2007-12-26 14:57:03.083077   system_inhibit[1]    full
```

--just <problem_type_1> <problem_type_2> ...
When used with--pvols to display one type of problem volumes. The most common values for problem types include (but not limited to):

3. migrated
4. readonly
5. full
6. NOACCESS
7. NOTALLOWED
8. duplicated

$ python info_client.py --pvols --just migrated

```
==== migrated
VO2140              0.90GB   (none       0509-1704 migrated 0811-0008)   9940
sdss.sdss_mt.cpio_odc                => VO8585
VO2141              0.90GB   (none       0509-1704 migrated 0811-0722)   9940
sdss.sdss_mt_2c.cpio_odc             => VO8585 VOB250
```

This is really just a sorting of system inhibits that are not 'none'. Full volumes are not considered problem volumes unless another condition (i.e. NOACCESS) is also there.

--labels
List all the volume names.

$ enstore info –labels

```
TEST00
TEST00.deleted
TEST01
TEST02
```

--query <SQL query>
Allows the user to issue an sql command to the database. Use of this command requires knowledge of the database scheme.

$ enstore info --query "select label from volume limit 10;"

```
                                    label
----------------------------------------
                                   JL4742
                             JL4742.deleted
rain:zee.shortcut_test.null:1116865327606
                                   NULL02
                                   NULL03
                                   NULL04
                                   NULL05
                                   STORM1
                             STORM4.deleted
                                   UPB018
```

--write-protect-status <VOLUME_NAME>
Prints in the write protect status is OFF, ON or UNKNOWN.

$ enstore info --write-protect-status TST001

```
TST001 write-protect OFF
```

3.7 enstore inquisitor

The **enstore inquisitor** commands have **enstore sched** as an alias.

Syntax:

```
% enstore inquisitor [--options [arguments] ...]
```

Options:

-h, --help

Prints the options (i.e. Prints this message). Example:

```
$ enstore file --help
Usage:
       inquisitor [OPTIONS]...

   -a, --alive               prints message if the server is up or down.
       --do-alarm <DO_ALARM>  turns on more alarms
       --do-log <DO_LOG>     turns on more verbose logging
       --do-print <DO_PRINT>  turns on more verbose output
       --dont-alarm <DONT_ALARM>  turns off more alarms
       --dont-log <DONT_LOG>  turns off more verbose logging
       --dont-print <DONT_PRINT>  turns off more verbose output
       --down <SERVER[,SERVER]>  servers to mark down
       --dump                print (stdout) state of servers in memory
       --get-last-alive <SERVER[,SERVER]>  return the last time a heartbeat
                             was received by the inquisitor for the listed
                             servers
       --get-max-encp-lines  return number of displayed lines on the encp
                             history web page
       --get-refresh         return the refresh interval for inquisitor
                             created web pages
       --get-update-interval  return the interval between updates of the
                             server system status web pages
   -h, --help                prints this messge
       --is-up <SERVER>      check if <server> is up
       --max-encp-lines <NUM_LINES>  set the number of displayed lines on the
                             encp history web page
       --nooutage <SERVER[,SERVER]>  remove the outage check from the SAAG
                             page for the specified servers
       --nooverride <SERVER[,SERVER]>  do not override the status of the
                             specified servers
       --outage <SERVER[,SERVER]>  set the outage check on the SAAG page for
                             the specified servers
       --override <SERVER[,SERVER]>  override the status of the specified
                             servers with the saagstatus option
       --reason <STRING>     information associated with a server marked down
                             or with an outage
       --refresh <SECONDS>   set the refresh interval for inquisitor created
                             web pages
       --retries <ALIVE_RETRIES>  number of attempts to resend alive requests
       --saagstatus <STATUS>  status to use for override
       --show                print (stdout) the servers scheduled down, known
                             down, seen down and overridden
       --subscribe           subscribe the inquisitor to the event relay
       --time <STRING>       information associated with a server marked down
                             or with an outage
       --timeout <SECONDS>   number of seconds to wait for alive response
       --up <SERVER[,SERVER]>  servers to mark up
       --update              update the server system status web page
       --update-and-exit     update the server system status web page and
                             exit the inquisitor
       --update-interval <SECONDS>  set the interval between updates of the
                             system servers status web page
       --usage               prints short help message
```

--down <SERVER[,SERVER]>
Mark a server as known down. Valid names include all entities that appear on the Mass Storage Status at-a-Glance. See also--reason, --up and --show.

```
$ enstore inquisitor --down LTO3.library_manager
```

--dump
This output goes to the file that stdout has been redirected to for the inquisitor; not the stdout for the inquisitor client.

```
$ enstore inquistor --dump
```

--get-last-alive <SERVER[,SERVER]>
Show the last time the requested server(s) sent a heartbeat message.

```
$ enstore inquisitor --get-last-alive rain.library_manager
rain.library_manager   Wed Mar 26 16:14:25 2008
```

--get-max-encp-lines
Show the number of lines displayed on the encp History web page. See --max-encp-lines to set this value.

```
$ enstore inquisitor --get-max-encp-lines
250
```

--get-refresh
Show the refresh interval in seconds for inquisitor created web pages. See--refresh to set this value.

```
$ enstore inquisitor --get-refresh
3600
```

--get-update-interval
Show the update interval in seconds between updates of the server system status web pages. See also --update-interval.

```
$ enstore inquisitor --get-update-interval
20
```

--is-up <SERVER>
Show if a server is up. This switch is script friendlier than --show.

```
$ enstore inquisitor --is-up LTO4_0.mover
no
```

--max-encp-lines <NUM_LINES>
Sets the maximum number of lines on the encp History web page. See also --get-max-encp-lines.

```
$ enstore inquisitor --get-max-encp-lines
250
$ enstore inquisitor --max-encp-lines 251

$ enstore inquisitor --get-max-encp-lines

251
```

--nooutage <SERVER[,SERVER]>
Removes the specified servers from the list of scheduled down servers. See also --outage.

```
$ enstore inquisitor --nooutage LTO4_0.mover
```

--nooverride <SERVER[,SERVER]>
See also --override.

--outage <SERVER[,SERVER]>
Adds the specified servers to the list of scheduled down servers. See also --nooutage.

```
$ enstore inquisitor --outage LTO4_0.mover
```

--override <SERVER[,SERVER]>
See also --nooverride.

--reason <STRING>
Adds a comment to explain why a server is down or has a scheduled outage. See also --up, --outage and--show.

```
$ enstore inquisitor –down LTO4_0.mover –reason “tape drive investigation”
```

--refresh <SECONDS>
Sets the number of seconds between updates on inquisitor created web pages. See also--get-refresh.

```
$ enstore inquisitor --get-refresh
3600
bash-3.00$ enstore inquisitor --refresh 5000

bash-3.00$ enstore inquisitor --get-refresh
5000
```

--saagstatus <STATUS>

--show
Show what Enstore severs are down or scheduled to be down.

$ enstore inquisitor --show

```
 Enstore Items Scheduled To Be Down
 ----------------------------------


 Enstore Items Known Down
 ------------------------
   DLT1.mover : fan to noisy


 Enstore Items Down and the Number of Times Seen Down
 ----------------------------------------------------
   Drivestat Server : 34853
   DLT1.mover : 61020
```

--subscribe
Subscribe the inquisitor to the event_relay.

$ enstore inquisitor --subscribe

--time <STRING>

--up <SERVER[,SERVER]>
Mark an Enstore server as being up. Valid names include all entities that appear on the Mass Storage Status-at-a-Glance. See also--reason, --down and --show.

$ enstore inquisitor --down LTO3.library_manager

--update
Tells the inquisitor to update the Enstore Server Status web page now instead of waiting for the next update interval. See also --update-and-exit.

$ enstore inquisitor --update

--update-and-exit
Tells the inquisitor to update the Enstore Server Status web page now instead of waiting for the next update interval. After the page is updated the inquisitor quits. See also --update.

$ enstore inquisitor --update-and-exit

--update-interval <SECONDS>
Sets the number of seconds between updates of the Enstore Server Status web page. See also --get-update-interval.

```
$ enstore inquisitor --get-update-interval
20
$ enstore inquisitor --update-interval 30

$ enstore inquisitor --get-update-interval
30
```

3.8 enstore library

Syntax:

```
% enstore library [--options [arguments] ...] \
<library>
```

Options:

--delete-work <UNIQUE_ID>
Remove the request with the specified unique ID from the queue.

```
$ enstore library --get-queue '' stk.library_manager
Pending write requests
testnode.fnal.gov stk.library_manager enstore /home/enstore/testfile
/pnfs/test/xyz/testfile P 0     FF zoo FF_W 1
Pending read requests:  0
Pending write requests:  1
Active read requests:  0
Active write requests:  0
{'status': ('ok', None)}
$ enstore library --delete-work \
testnode.fnal.gov-1202315917-17575-0 stk
{'status': ('ok', 'Work deleted')}
$ enstore library --get-queue '' stk
Pending read requests:  0
Pending write requests:  0
Active read requests:  0
Active write requests:  0
{'status': ('ok', None)}
```

--priority <UNIQUE_ID> <PRIORITY>
Set the priority for the request with the specified unique id.

```
$ enstore library --priority \
testnode.fnal.gov-1202315917-17575-0 5 stk.library_manager
{'status': ('ok', 'Priority changed')}
```

--rm-active-vol <VOLUME>
This command removes the volume from the list of active volumes.

This command should only be used when it is known that the tape is not located in the assigned tape drive. This command is usually used after an error occurred and the tape needed to be ejected manually from the tape drive. The library manager will not schedule requests for a different tape drive for a tape while it believes the tape is still in a drive.

```
$ enstore library --rm-active-vol TEST01L1 stk.library_manager
```

--rm-suspect-vol <VOLUME>
This command removes the volume from the suspect volume list. This list keeps track of volume with mover combinations that result in media errors. The library manager will not assign a suspect volume to its matching suspect movers.

```
$ enstore library --rm-suspect-vol TST001 stk.library_manager
```

--start-draining <LIBRARY STATE>
Tell the library to stop assigning requests to movers. The normal state is unlocked, however it can be set to:

7. **lock** – Stop assigning any new requests to movers. If a new encp request is received return an error.
8. **ignore** - Stop assigning any new requests to movers. If a new encp request is received return a success message to encp, but do not insert the request into the queue.
9. **pause** - Stop assigning any new requests to movers. If a new encp request is received return a success message to encp and put the request at the end of the queue.
10. **noread** – If a read request is received an error is returned to encp. If a write request is received it is processed normally.
11. **nowrite** – If a write request is received an error is returned to encp. If a read request is received it is processed normally.

See --stop-draining and --status.

```
$ enstore library --status aml2.library_manager
LM state:unlocked
$ enstore library --start-draining lock aml2

$ enstore library --status aml2
LM state:locked
```

--status
Print the current state of the library manager: It will be one of: unlocked, locked, pause, ignore, noread or nowrite. See--start-draining and--stop draining for more information and examples.

--stop-draining
Set the state of the library manager back to its default state. Most often this is the unlocked state. A different default state can be set in the configuration; see section 5.4. If this is set in this libraries configuration, then it will be set back to that value.

```
$ enstore library --status SL8500.library_manager
LM state:nowrite
$ enstore library --stop-draining SL8500

$ enstore library --status SL8500
LM state:unlocked
```

--vols
Reports information on the current state of the active volumes and their currently associated movers.

```
$ enstore library --vols CDF-LTO3
label      mover             tot.time status               system_inhibit
rq. host         updated           volume family
IAD655     LTO3_24.mover     28       IDLE          (0    ) (none
full) fcdfdata107      02-06-08 14:24:31 cdf.cdfpstn.cpio_odc
IAB451     LTO3_01.mover     286      HAVE_BOUND    (30   ) (none
full) fcdfdata098      02-06-08 14:24:54 cdf.cdfptnt.cpio_odc
IAD726     LTO3_31.mover     664      ACTIVE-READ   (4    ) (none
full) fcdfdata105      02-06-08 14:24:50 cdf.cdfpstn.cpio_odc
```

3.9 enstore log

Syntax:
```
% enstore log [--options [arguments] ...]
```
Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

$ enstore log --help

```
Usage:
       log [OPTIONS]...

   -a, --alive               prints message if the server is up or down.
       --client-name <CLIENT_NAME>  set log client name
       --do-alarm <DO_ALARM>  turns on more alarms
       --do-log <DO_LOG>     turns on more verbose logging
       --do-print <DO_PRINT>  turns on more verbose output
       --dont-alarm <DONT_ALARM>  turns off more alarms
       --dont-log <DONT_LOG>  turns off more verbose logging
       --dont-print <DONT_PRINT>  turns off more verbose output
       --get-last-logfile-name  return the fname of yesturdays log file
       --get-logfile-name    return the name of the current log file
       --get-logfiles <PERIOD>  return the last 'n' log file names (today,
                             week, month, all)
   -h, --help                prints this messge
       --message <MESSAGE>   log a message
       --retries <ALIVE_RETRIES>  number of attempts to resend alive requests
       --timeout <SECONDS>   number of seconds to wait for alive response
       --usage               prints short help message
```

--client-name
When used with--message this switch will set the client name recorded in the log file. See--message for an example. The default name, when this switch is not used is, LOG_CLIENT.

--get-last-logfile-name
Return the name of yesterdays log file.

$ enstore log –get-last-logfile-name

```
/diska/enstore-log/LOG-2008-02-05
```

--get-logfile-name
Return the name of todays log file.

$ enstore log –get-logfile-name

```
/diska/enstore-log/LOG-2008-02-06
```

--get-logfiles

--message <MESSAGE>
Send a message to the log server to be placed in the log file. See --client-name.

$ enstore log –message “This is a test message.” --client-name “MY_SCRIPT”

3.10 enstore media

Syntax:

```
% enstore media [--options [arguments] ...] \
<media_changer>
```

Options:

-h, --help

Prints the options (i.e. Prints this message). Example:

$ enstore media --help

```
Usage:
       media [OPTIONS]...

   -a, --alive               prints message if the server is up or down.
       --dismount <EXTERNAL_LABEL> <DRIVE>
       --do-alarm <DO_ALARM>  turns on more alarms
       --do-log <DO_LOG>     turns on more verbose logging
       --do-print <DO_PRINT>  turns on more verbose output
       --dont-alarm <DONT_ALARM>  turns off more alarms
       --dont-log <DONT_LOG>  turns off more verbose logging
       --dont-print <DONT_PRINT>  turns off more verbose output
       --get-work
   -h, --help                prints this messge
       --list                list all media changers in configuration
       --list-clean          List cleaning volumes.
       --list-drives         List all drives.
       --list-slots          List all slot counts.
       --list-volumes        List all volumes.
       --max-work <MAX_WORK>
       --mount <EXTERNAL_LABEL> <DRIVE>
       --retries <ALIVE_RETRIES>  number of attempts to resend alive requests
       --show
       --show-drive <DRIVE>
       --show-robot
       --show-volume <VOLUME> <MEDIA_TYPE>  Returns information about a
volume.
       --timeout <SECONDS>   number of seconds to wait for alive response
       --usage               prints short help message
```

--dismount

Move a volume from the mouth of a drive to a slot in the media library. See also --mount.

$ enstore media --dismount TST001 LTO-800G stk.media_changer

--get-work

Print various pieces of information about the current list of outstanding media relocation requests.

$ enstore media --get-work SL8500.media_changer

```
{'max_work': 10,
 'status': ('ok', 0, None),
 'worklist': [('mount', 'VOF764', '0,3,1,1'),
              ('mount', 'VOG033', '0,2,1,12'),
              ('mount', 'VOG586', '0,1,1,12'),
              ('dismount', 'VOG014', '0,1,1,1'),
              ('mount', 'VOG365', '0,0,1,3'),
              ('dismount', 'VOG727', '0,3,1,13')]}
```

-list-clean

Report on the number of cleanings remaining for cleaning tapes.

```
$ enstore media --list-clean SL8500G1.media_changer
```

```
          volume       type        max    current  remaining
          CLN006   LTO-CLNU         50         50          0
          CLN007   LTO-CLNU         50         50          0
          CLN008   LTO-CLNU         50         50          0
          CLN009   LTO-CLNU         50         45          5
          CLN010   LTO-CLNU         50         28         22
          CLN011   LTO-CLNU         50          1         49
          CLN013   LTO-CLNU         50         50          0
          CLN014   LTO-CLNU         50         16         34
          CLN015   LTO-CLNU         50         20         30
```

--list-drives

List the available drives and some information about them.

```
$ enstore media --list-drives stk.media_changer
```

```
        name           state          status           type   volume
    0,0,10,0          online       available          T9940B
    0,0,10,1          online       available          T9940B
    0,0,10,2          online       available          T9940A
    0,0,10,4          online       available          T9940B
    0,0,10,5          online       available          T9940B
    0,0,10,6          online          in use          T9940B   VOB915
    0,0,10,7          online          in use          T9940B   VO2688
```

--list-slots

Report on the current number of media slots that are used and empty.

```
$ enstore media --list-slots aml2.media_changer
```

```
    location   media type      total       free       used   disabled
        ST01       DECDLT       4320       4294         26          0
        ST02         3480       4800       1603       3197          0
        ST03         3480       4800         82       4718          0
```

--list-volumes

List the available volumes and some information about them. This command can take a while (sometimes several minutes) to complete.

```
$ enstore media --list-volumes aml2.media_changer
```

```
          volume       type                state             location
        270PROL1       3480                    O
        797PROL1       3480                    O
        835PROL1       3480                    O
        836PROL1       3480                    O
        899PROL1       3480                    O
          CA2530     DECDLT                    O
          CA2531     DECDLT                    O
          CA2532     DECDLT                    O
```

For the AML2 media changers:

- The location column is left blank.
- Some tapes are reported backwards. 270PROL1 from above is really PRO270L1, but CA2530 really is CA2530.

--max-work <MAX_WORK>
Override the default max work parameter with the user supplied value. See also --get-work.

```
$ enstore media --get-work test.media_changer
{'status': ('ok', 0, None), 'max_work': 7, 'worklist': []}
bash-3.00$ enstore media --max-work 10 test.media_changer

bash-3.00$ enstore media --get-work test.media_changer
{'status': ('ok', 0, None), 'max_work': 10, 'worklist': []}
```

--mount <EXTERNAL_LABEL> <DRIVE>
Move a volume from the its media slot and insert it into a drive. See also --dismount.

```
$ enstore media –mount TST001 0,5,1,0 SL8500.media_changer
```

--show
Determine if the robot is available and report the status back to the user.

```
$ enstore media --show SL8500.media_changer
2008-02-06:16:27:21 4.320000 ('ok', 0, 'query server => 0,run             ,
4.320000')
```

--show-drive <DRIVE>
Show information about a specific drive.

```
$ enstore med --show-drive DG4A aml2
       name           state          status            type   volume
       DG4A             up               0       6380/7480
```

For the AML2 media changer:

- The (letter) O status means the tape is **O**ccupied in its slot.
- The **M** status means that it is mounted in a drive.

For the STK media changer:

- **home** status means that it is located in it slot.
- **In use** status means that is is mounted in a drive.

--show-robot
Reserved to show the state of the robot in a more generic format than --show. Currently is an alias to --show.

--show-volume
Show information about a specific volume.

```
$ enstore med --show-volume PRO270L1 DECDLT aml2.media_changer
```

```
          volume       type               state            location
        PRO270L1       3480                   O
```

For the AML2 media changers:

- The location column is left blank.
- The (letter) O status means the tape is **O**ccupied in its slot.
- The **M** status means that it is mounted in a drive.

For the STK media changer:

- **home** status means that it is located in it slot.
- **In use** status means that is is mounted in a drive.

3.11 enstore monitor

Without any switches or arguments, `enstore monitor` contacts all Enstore machines to run a simple network rate test. The results are then sent to the monitor server running on the same machine as the configuration server and web server. If the monitor server on the configuration server and web server node is not running then this command will eventually timeout, but will run very slowly.

Syntax:

```
% enstore monitor [--options [arguments] ...]
```

Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

```
$ enstore monitor --help
```

```
Usage:
       mon [OPTIONS]...

   -a, --alive               prints message if the server is up or down.
   -h, --help                prints this messge
       --host <HOSTIP>       selects a single host
       --html-gen-host <HTML_GEN_HOST>  ip/hostname of the html server
       --port <PORT>         selects a port
       --retries <ALIVE_RETRIES>  number of attempts to resend alive requests
       --summary             summary for saag
       --timeout <SECONDS>   number of seconds to wait for alive response
       --usage               prints short help message
       --verbose <VERBOSE>   print out information.
```

--host <HOSTIP>
Specify a single host to run the rate test with. By default all Enstore hosts are contacted. HOSTIP is allowed to be a host name or IP address.

```
$ enstore monitor --host stkensrv2.fnal.gov
Trying stkensrv2.fnal.gov
Network rate measured at 11.16 MB/S recieving and 11.25 MB/S sending.
```

--html-gen-host <HTML_GEN_HOST>
This switch allows for the user to override the default hostname of the primary monitor server. Normally the rate results are sent to the monitor server running on the same node as the configuration server and the web server.

```
$ enstore monitor --host stkensrv2.fnal.gov --html-gen-host
gccensrv1.fnal.gov
Trying stkensrv2.fnal.gov
Network rate measured at 11.19 MB/S recieving and 11.24 MB/S sending.
```

--port
This switch is needed to use communicate with a monitor server that was started using a different port number than the default 7499.

```
$ enstore monitor --host stkensrv2.fnal.gov --port 7499
Trying stkensrv2.fnal.gov
Network rate measured at 11.18 MB/S recieving and 11 MB/S sending.
```

--summary
This switch outputs a python dictionary that is used internally by the **enstore network** command.

3.12 enstore mover

Syntax:

```
% enstore mover [--options [arguments] ...] <mover>
```

Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

$ enstore mover --help

```
Usage:
       mov [OPTIONS]... mover_name


   -a, --alive               prints message if the server is up or down.
       --clean-drive         clean tape drive
       --do-alarm <DO_ALARM>  turns on more alarms
       --do-log <DO_LOG>     turns on more verbose logging
       --do-print <DO_PRINT>  turns on more verbose output
       --dont-alarm <DONT_ALARM>  turns off more alarms
       --dont-log <DONT_LOG>  turns off more verbose logging
       --dont-print <DONT_PRINT>  turns off more verbose output
       --down                set mover to offline state
       --dump                get the tape drive dump (used only with M2
                             movers)
   -h, --help                prints this messge
       --list                list all movers in configuration
       --mover_dump          send mover internals to stdout
       --notify <E_MAIL_ADDRESS>  send e-mail.  Used with --dump option only
       --offline             set to offline state
       --online              set to online state
       --retries <ALIVE_RETRIES>  number of attempts to resend alive requests
       --sendto <E_MAIL_ADDRESS>  send e-mail.  Used with --dump option only
       --status              print mover status
       --timeout <SECONDS>   number of seconds to wait for alive response
       --up                  set mover to online state
       --usage               prints short help message
       --warm-restart        gracefully restart the mover
```

--clean-drive
Clean the drive associated with the mover.

$ enstore mover --clean-drive 9940B27.mover

--down
Set the mover to the offline state. This will prevent the mover from requesting additional work items from the library manager. This is the same command as --offline.

$ enstore mover --down LTO3_06.mover

--dump
Output the tape drive dump. This output goes to the file that stdout has been redirected to for the mover; not the stdout for the mover client. Only works with Mammoth 2 tape drives.

$ enstore mover --dump M201.mover

--mover_dump
Output the mover internals dump. This output goes to the file that stdout has been redirected to for the mover; not the stdout for the mover client.

$ enstore mover --mover-dump 9940B27.mover

--notify <E_MAIL_ADDRESS>

--offline
Set the mover to the offline state. This will prevent the mover from requesting additional work items from the library manager. This is the same command as --down.

```
$ enstore mover –offline LTO3_06.mover
```

--online
Set the mover to the online state. This will allow the mover to begin requesting additional work items from the library manager. This is the same command as --up.

```
$ enstore mover –online 9940B27.mover
```

--sendto <E_MAIL_ADDRESS>

--status
Prints in native python format current status and/or state information about the mover.

```
$ enstore mov --status LTO3_06.mover
{'buffer': 'Buffer 67108864  79691776  2621440000',
 'buffer_max': 2621440000L,
 'buffer_min': 67108864L,
 'bytes_buffered': 79691776,
 'bytes_read': 347280136L,
 'bytes_read_last': 347280136L,
 'bytes_to_transfer': 2440004730L,
 'bytes_written': 267386880L,
 'client': '131.225.189.74',
 'current_location': 6,
 'current_volume': 'VOI177',
 'default_dismount_delay': 20,
 'drive_id': 'ULTRIUM-TD3',
 'drive_sn': '1210116666',
 'drive_vendor': 'IBM',
 'files': ('cmsstor74.fnal.gov:/storage/data1/write-pool-
1/data/000700000000000FBD84E8',
           '/pnfs/fnal.gov/usr/cms/WAX/11/store/mc/2008/2/6/TaS-W0jet-alpgen-
Skim_01_AODSIM/0003/64C34427-68D5-DC11-AF3B-0018F3D09702.root'),
 'last_error': ('ok', None),
 'last_location': 34,
 'last_volume': 'VOE330',
 'max_dismount_delay': 600,
 'mode': 'WRITE',
 'rate of network': 54970350.576162718,
 'rate of tape': 71208384.297553152,
 'state': 'ACTIVE',
 'status': ('ok', None),
 'successful_writes': 56,
 'time_in_state': 6.3608489036560059,
 'time_stamp': 1202403301.7609749,
 'transfers_completed': 189,
 'transfers_failed': 0}
```

--up
Set the mover to the online state. This will allow the mover to begin requesting additional work items from the library manager. This is the same command as --online.

```
$ enstore mover –up 9940B27.mover
```

--warm-restart
Using this switch will instruct the mover to restart. If a file transfer is currently in progress, the restart is delayed until the transfer is completed, the volume is ejected and the volume is put away.

```
$ enstore mover –warm-restart --M201.mover
```

3.13 enstore network

Syntax:
`% enstore network [--options [arguments] ...]`
Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

```
$ enstore network --help
Usage:
       network [ -h --help --html-gen-host= --usage ]

   -h, --help                prints this messge
       --html-gen-host <NODE_NAME>  ip/hostname of the html server
       --usage               prints short help message
```

--html_gen_host
See section 1.11 for the `enstore monitor --html-gen-host` command.

3.14 enstore pnfs

Syntax:
`% enstore pnfs [--options [arguments] ...]`
Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

$ enstore pnfs --help

```
Usage:
       pnfs [OPTIONS]...

       --bfid <FILENAME>     lists the bit file id for file
       --cat <FILENAME> [LAYER]  see --layer
       --const <FILENAME>
       --counters <FILENAME>
       --countersN <DBNUM>   (must have cwd in pnfs)
       --cp <UNIXFILE> <FILENAME> <LAYER>  echos text to named layer of the
                             file
       --cursor <FILENAME>
       --database <FILENAME>
       --databaseN <DBNUM>   (must have cwd in pnfs)
       --down <REASON>       creates enstore system-down wormhole to prevent
                             transfers
       --dump                dumps info
       --duplicate [FILENAME] [DUPLICATE_FILENAME]  gets/sets duplicate file
                             values
       --echo <TEXT> <FILENAME> <LAYER>  sets text to named layer of the file
       --file-family [FILE_FAMILY]  gets file family tag, default; sets file
                             family tag, optional
       --file-family-width [FILE_FAMILY_WIDTH]  gets file family width tag,
                             default; sets file family width tag, optional
       --file-family-wrapper [FILE_FAMILY_WRAPPER]  gets file family wrapper
                             tag, default; sets file family wrapper tag,
                             optional
       --filesize <FILE>     print out real filesize
   -h, --help                prints this messge
       --id <FILENAME>       prints the pnfs id
       --info <FILENAME>     see --xref
       --io <FILENAME>       sets io mode (can't clear it easily)
       --layer <FILENAME> [LAYER]  lists the layer of the file
       --library [LIBRARY]   gets library tag, default; sets library tag,
                             optional
       --ls <FILENAME> [LAYER]  does an ls on the named layer in the file
       --mount-point <FILENAME>  prints the mount point of the pnfs file or
                             directory
       --nameof <PNFS_ID>    prints the filename of the pnfs id (CWD must be
                             under /pnfs)
       --parent <PNFS_ID>    prints the pnfs id of the parent directory (CWD
                             must be under /pnfs)
       --path <PNFS_ID>      prints the file path of the pnfs id (CWD must be
                             under /pnfs)
       --position <FILENAME>
       --rm <FILENAME> <LAYER>  deletes (clears) named layer of the file
       --showid <PNFS_ID>    prints the pnfs id information
       --size <FILENAME> <FILESIZE>  sets the size of the file
       --storage-group [STORAGE_GROUP]  gets storage group tag, default; sets
                             storage group tag, optional
       --tag <TAG> [DIRECTORY]  lists the tag of the directory
       --tagchmod <PERMISSIONS> <TAG> changes the permissions for the tag;use
                             UNIX chmod style permissions
       --tagchown <OWNER> <TAG>  changes the ownership for the tag; OWNER can
                             be 'owner' or 'owner.group'
       --tagecho <TEXT> <TAG>  echos text to named tag
       --tagrm <TAG>         removes the tag (tricky, see DESY documentation)
       --tags [DIRECTORY]    lists tag values and permissions
       --up                  removes enstore system-down wormhole
       --usage               prints short help message
       --xref <FILENAME>     lists the cross reference data for file
```

--const <FILENAME>
Outputs constant information from pnfs for a target file or directory in PNFS.

$ enstore --const /pnfs/test/mydir

```
MD2_P_VERSION=30109
MD2_RECORD_LENGTH=1012
MD_MAX_NAME_LENGTH=200
MD_HASH_SIZE=128
MAX_BODY_SIZE=928
MAX_TAG_NAME_SIZE=62
TAG_DATA_SIZE=762
HASH_HANDLES=66
HASH_POINTERS=77
DATA_POINTERS=77
DIR_ITEMS=3
DATA_UNITS=928
```

This shell command has the same result.

$ cat “/pnfs/test/.(const)(NULL)”

--counters <FILENAME>
Outputs constant information from pnfs for a target file or directory in PNFS.

$ enstore pnfs --counters /pnfs/test/mydir

```
mist=1
time=1202415188
getroot=0
get_record=87
getattr=162567
lookup=53634
mkdir=0
setattr=269
rmdir=0
readdir=438
mkfile=63
rmfile=66
rename=35
mklink=0
readlink=42
readdata=4089
writedata=66
setsize=0
setperm=0
truncate=0
rmfromdir=32
addtodir=32
chparent=0
delobject=0
forcesize=0
NULL=0
looponly=32
command=0
get_chain=0
find_id=64
mod_link=64
setattrs=0
rmfromdirpos=0
mod_flags=0
```

This shell command has the same result.

$ cat “/pnfs/test/mydir/.(get)(counters)”

--countersN <DBNUM>

--cp <UNIXFILE> <FILENAME> <LAYER>
Copies a text file into the named layer of the specified file. In the following example, the contents of /tmp/L4 are copied into layer 4 of the file /pnfs/test/mydir/somefile. This is similar to what --echo does, but makes it easier to write multi line output to the layer.

To see what we currently have and what we believe we will want to replace the layer information with. Note the difference between the volume name and the location.

$ cat /tmp/L4

```
TEST01
0000_000000000_0000397
1024
my_file_family
/pnfs/test/mydir/somefile

000100000000000000018820

WAMS103661998200000
testnode:/dev/null:0
```

$ enstore pnfs --layer /pnfs/test/mydir/somefile 4

```
TEST42
0000_000000000_0000402
1024
my_file_family
/pnfs/test/mydir/somefile

000100000000000000018820

WAMS103661998200000
testnode:/dev/null:0
```

Now update the layer 4 information.

$ enstore pnfs --cp /tmp/L4 /pnfs/test/mydir/somefile 4

Verify that the contents are what we expect.

$ enstore pnfs --xref /pnfs/test/mydir/somefile

```
volume: NULL01
location_cookie: 0000_000000000_0000397
size: 1024
file_family: my_file_family
original_name: /pnfs/test/mydir/somefile
map_file:
pnfsid_file: 000100000000000000018820
pnfsid_map:
bfid: WAMS103661998200000
origdrive: testnode:/dev/null:0
crc: unknown
```

--cursor <FILENAME>
Outputs the PNFS specific cursor information to standard out about the specified directory or parent directory of the file specified.

```
$ enstore pnfs --cursor /pnfs/test
```

```
dirID=0001000000000000000010A8
dirPerm=0000001400000020
mountID=0001000000000000000001060
```

This shell command has the same result.

```
$ cat "/pnfs/test/.(get)(cursor)"
```

--database <FILENAME>
Output the PNFS database information for the specified file or directory.

```
$ enstore pnfs --database /pnfs/data1
```

```
data1:1:r:enabled:/diska/pnfsdb/pnfs/databases/data1
```

This shell command has the same result.

```
$ cat "/pnfs/data1/.(get)(database)"
```

--databaseN

--dump
After the command is completed, additional diagnostic information is also printed to standard out.

--echo <TEXT> <FILENAME> <LAYER>
Writes the contents of TEXT into the named layer of the specified file. This switch is most useful in writing information to layer 1 of a file.

Look at the current layer 1 information.

```
$ enstore pnfs --layer /pnfs/test/mydir/somefile 1
```

```
WAMS103667492900000
```

Update the layer 1 information.

```
$ enstore pnfs --echo \
WAMS103661998200000 /pnfs/test/mydir/somefile 1
```

Verify that the value is now correct.

```
$ enstore pnfs --bfid /pnfs/test/mydir/somefile
```

```
WAMS103661998200000
```

--id <FILENAME>
Outputs the pnfsid of the specified filename or directory.

```
$ enstore pnfs --id /pnfs/test/mydir/somefile
000100000000000000018820
```

This shell command has the same result.

```
$ cat "/pnfs/test/mydir/.(id)(somefile)"
```

--io <FILENAME>
Feature not yet implemented.

--ls
Forks an ls on the named layer of a file.

```
$ enstore pnfs --ls /pnfs/test/mydir/fname
-rw-r-----  1 enstore g023 127 Nov  6  2002 /pnfs/test/mydir/.(use)(4)(fname)
```

This shell command has the same result.

```
$ ls -l "/pnfs/test/mydir/.(use)(4)(fname)"
```

--mount-point <FILENAME>
Outputs the directory that is the mount point for the mounted PNFS file system that the specified file or directory belongs to.

```
$ enstore pnfs --mount-point /pnfs/test/mydir/somefile
/pnfs/test
```

--nameof <PNFS_ID>
Output the name of the file or directory with the specified pnfsid.

```
$ enstore pnfs --nameof 000100000000000000018820
somefile
```

This shell command has the same result.

```
$ cat "/pnfs/test/.(nameof)(000100000000000000018820)"
```

--parent <PNFS_ID>
Output the pnfsid parent directory of the file or directory with the specified pnfsid.

```
$ enstore pnfs --parent 000100000000000000018820
000100000000000000010A8
$ enstore pnfs --nameof 000100000000000000010A8
mydir
```

This shell command has the same result.

```
$ cat "/pnfs/test/.(parent)(000100000000000000018820)"
```

--path <PNFS_ID>
Outputs the full path of the file with the specified pnfsid.
WARNING: This command must be used with care. It launches a linear search through the entire PNFS database for each component in the full file path. Abuse of this command will result incredibly slow response times from PNFS.
Note: If multiple PNFS servers are mounted on a single machine it is possible that multiple matches are found. When this happens; the error message is sent to standard error, a non-success exit status is returned and all of the matched paths are printed to standard out.

```
$ enstore pnfs --path 0001000000000000000010A8
/pnfs/test/mydir
$ enstore pnfs --path 000100000000000000018820
/pnfs/test/mydir/somefile
```

A similar command is the pathfinder PNFS utility.

```
# pathfinder 0001000000000000000E468
0001000000000000000E468 testfile6
0001000000000000000010A8 mydir
0001000000000000000001060 test
0000000000000000000001080 usr
0000000000000000000001040 fs
0000000000000000000001020 root
0000000000000000000001000 -
0000000000000000000000100 -
0000000000000000000000000 -
/root/fs/usr/test/mydir/testfile6
```

--position <DIRECTORY>
Outputs the PNFS specific position information to standard out about the specified directory.

```
$ enstore pnfs –postion /pnfs/test
dirID=0001000000000000000010A8
dirPerm=0000001400000020
mountID=000100000000000000001060
```

This shell command has the same result.

```
$ cat “/pnfs/test/.(get)(position)”
```

--rm <FILENAME> <LAYER>
Feature not yet implemented.

--showid <PNFS_ID>
Outputs PNFS information about the specified pnfsid.

```
$ enstore pnfs –id /pnfs/test/mydir/somefile
000100000000000000018820
$ enstore pnfs –showid 000100000000000000018820
 ----------------------------------------------------
 ID            : 000100000000000000018820
 Type          : --I---r----
 next ID       : 000000000000000000000000
 base ID       : 000000000000000000000000
 parent ID     : 000100000000000000000010A8
 creation time : Wed Nov  6 15:59:39 2002
 modif. time   : Thu Feb  7 14:40:18 2008
 Type          : Regular ( Inode )
 Info bytesPerBlock : 928
 Info blocksPerhash : 77
 mst_dev        : 1
 mst_ino        : 16877600
 mst_mode       : 100640
 mst_nlink      : 1
 mst_uid        : 9276
 mst_gid        : 1530
 mst_rdev       : 100
 mst_size       : 1024
 mst_atime      : Thu Nov 29 10:37:31 2007
 mst_mtime      : Wed Nov  6 15:59:42 2002
 mst_ctime      : Wed Nov  6 15:59:39 2002
 mst_blksize    : 512
 mst_blocks     : 0
 Entries(0)       : 0
 Chain(0)         : 000000000000000000000000
 Group(0)         : 0
 Entries(1)       : 19
 Chain(1)         : 000100000000000000018830
 Group(1)         : 0
 Entries(2)       : 0
 Chain(2)         : 000000000000000000000000
 Group(2)         : 0
 Entries(3)       : 0
 Chain(3)         : 000000000000000000000000
 Group(3)         : 0
 Entries(4)       : 127
 Chain(4)         : 000100000000000000018838
 Group(4)         : 0
 Entries(5)       : 0
 Chain(5)         : 000000000000000000000000
 Group(5)         : 0
 Entries(6)       : 0
 Chain(6)         : 000000000000000000000000
 Group(6)         : 0
 Entries(7)       : 0
 Chain(7)         : 000000000000000000000000
 Group(7)         : 0
```

This shell command has the same result.

```
cat "/pnfs/test/.(showid)(000100000000000000018820)"
```

--size <FILENAME> <SIZE>
Sets the file size as seen by the C library stat() function call.

```
$ ls -l /pnfs/test/mydir/zerofile
-rw-rw-r--  1 enstore g023 0 Feb  7 15:52 /pnfs/test/mydir/zerofile
$ enstore pnfs --size /pnfs/test/mydir/zerofile 123456

$ ls -l /pnfs/test/mydir/zerofile
-rw-rw-r--  1 enstore g023 123456 Feb  7 15:55 /pnfs/test/mydir/zerofile
```

--storage-group [STORAGE_GROUP]
Similar to --file-family, --file-family-width, --file-family-wrapper and --library. See the User's Guide for descriptions to those switches. All storage group tag files should be owned by root; thus requiring the effective user id to be root in order to modify the storage group. The current working directory must be in the PNFS directory whose tags need to be viewed or modified. See also --tagecho.

```
$ enstore pnfs --storage-group
old_storage_group
# enstore pnfs --storage-group new_storage_group

$ enstore pnfs --storage-group
new_storage_group
```

--tagecho <TEXT> <TAG>
Write the contents of TEXT to the named tag.

```
# enstore pnfs --tagecho new_storage_group storage_group
```

See also --file-family, --file-family-width, --file-family-wrapper and--library in the User's Guide and --storage-group. The current working directory must be in the PNFS directory whose tags need to be viewed or modified.

--tagrm <TAG>
Feature not yet implemented.

3.15 enstore pnfs_agent

Syntax:

```
% enstore pnfs_agent [--options [arguments] ...]
```

Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

```
$ enstore pnfs_agent --help
```

```
Usage:
       pnfs_agent [OPTIONS]...

   -a, --alive               prints message if the server is up or down.
       --do-alarm <DO_ALARM>  turns on more alarms
       --do-log <DO_LOG>     turns on more verbose logging
       --do-print <DO_PRINT>  turns on more verbose output
       --dont-alarm <DONT_ALARM>  turns off more alarms
       --dont-log <DONT_LOG>  turns off more verbose logging
       --dont-print <DONT_PRINT>  turns off more verbose output
   -h, --help                prints this messge
       --retries <ALIVE_RETRIES>  number of attempts to resend alive requests
       --status              print pnfs_agent status
       --timeout <SECONDS>   number of seconds to wait for alive response
       --usage               prints short help message
```

3.16 enstore quota

Syntax:

```
% enstore quota [--options [arguments] ...]
```

Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

```
$ enstore quota --help
```

```
Usage:
       quota [OPTIONS]...

       --create <LIBRARY> <STORAGE_GROUP> [REQUESTED] [AUTHORIZED] [QUOTA]
create quota for (library, storage_group
                          )
       --delete <LIBRARY> <STORAGE_GROUP>  delete (library, storage_group)
       --disable             disable quota
       --enable              enable quota
   -h, --help                prints this messge
       --set-authorized <LIBRARY> <STORAGE_GROUP> <NUMBER>  set authorized
                          number for (library, storage_group)
       --set-quota <LIBRARY> <STORAGE_GROUP> <NUMBER>  set quota for
(library,
                          storage_group)
       --set-requested <LIBRARY> <STORAGE_GROUP> <NUMBER>  set requested
number
                          for (library, storage_group)
       --show [LIBRARY] [STORAGE_GROUP]  show quota
       --show-by-library     show quota by the libraries
       --usage               prints short help message
```

--create <LIBRARY> <STORAGE_GROUP> [REQUESTED] [AUTHORIZED] [QUOTA]

--delete <LIBRARY> <STORAGE_GROUP>
--disable
--enable
--set-authorized <LIBRARY> <STORAGE_GROUP> <NUMBER>
--set-quota <LIBRARY> <STORAGE_GROUP> <NUMBER>
--set-requested <LIBRARY> <STORAGE_GROUP> <NUMBER>
--show [LIBRARY] [STORAGE_GROUP]
--show-by-library

3.17 enstore ratekeeper

Syntax:

```
% enstore ratekeeper [--options [arguments] ...]
```

Options:

-h, --help

Prints the options (i.e. Prints this message). Example:

```
$ enstore ratekeeper --help
Usage:
       ratekeeper [ -ha --alive --help --retries= --timeout= --usage ]

   -a, --alive               prints message if the server is up or down.
   -h, --help                prints this messge
       --retries <ALIVE_RETRIES>  number of attempts to resend alive requests
       --timeout <SECONDS>   number of seconds to wait for alive response
       --usage               prints short help message
```

3.18 enstore restart

Without any switches or arguments, this restarts most Enstore processes on the current host. See also **`enstore start`** and **`enstore stop`**.

Syntax:

```
% enstore restart [--options [arguments] ...]
```

Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

```
$ enstore restart --help
```

```
Usage:
       restart [ -h --all --help --just= --usage ]

       --all                 specify all servers
   -h, --help                prints this messge
       --just <SERVER NAME>  specify single server
       --usage               prints short help message
```

--all
Restart all Enstore processes on the current host. This includes the `monitor server` and `pnfs_agent` excluded by the default list without any switches or arguments.

--just <SERVER_NAME>
Restart just the server specified.

```
$ enstore restart --just log_server
```

```
Checking log_server.
Stopping log_server: 131.225.84.1:7504
Stopped log_server.
Starting log_server: 131.225.84.1:7504
```

3.19 enstore scanfiles

Without any arguments the scan will default to reading targets from standard input. Without the –vol or –bfid switches, the scan defaults to treating the input values as filenames.
Syntax:

```
% enstore scanfiles [--options [arguments] ...]
```

Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

```
$ enstore scanfiles –help
```

```
Usage:
       scan [OPTIONS]... [target_path [target_path_2 ...]]


       --bfid                treat input as bfids
   -h, --help                prints this messge
       --infile <INFILE>     Use the contents of this file as a list of
                             targets to scan.
       --profile             Display profile info on exit.
       --usage               prints short help message
       --vol                 treat input as volumes
```

--bfid
Treat the input as BFIDs; not filenames.

```
$ enstore scanfiles --bfid WAMS103661998200000
WAMS103661998200000 ... NULL01 0000_000000000_0000397 /pnfs/test/fname ... OK
```

--infile <INFILE>
Read input from file INFILE instead of standard in or the argument list.

--profile
Run the scan with the python interpreter going.

--vol
Treat the input as volumess; not filenames.

```
$ enstore scanfiles --vol TST003
WAMS105000802500000 ... TST003 0000_000000000_0000002 /pnfs/test/file1 ... OK
WAMS105000805800000 ... TST003 0000_000000000_0000005 /pnfs/test/file2 ... OK
WAMS105355386700000 ... TST003 0000_000000000_0000008 /pnfs/test/file3 ... OK
WAMS105355393900000 ... TST003 0000_000000000_0000011 /pnfs/test/file4 ... OK
WAMS108559067600000 ... TST003 0000_000000000_0000023 /pnfs/test/file5 ... OK
```

3.20 enstore schedule

See enstore inquisitor command.

3.21 enstore start

Without any switches or arguments, this starts most Enstore processes on the current host. See also **`enstore stop`** and **`enstore restart`**.
Syntax:
`% enstore start [--options [arguments] ...]`
Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

```
$ enstore start --help
Usage:
       restart [ -h --all --help --just= --usage ]

       --all                specify all servers
   -h, --help               prints this messge
       --just <SERVER NAME> specify single server
       --nocheck            do not check if server is already running.
       --usage              prints short help message
```

--all
Start all Enstore processes on the current host. This includes the `monitor server` and `pnfs_agent` excluded by the default list without any switches or arguments.

--just <SERVER_NAME>
Start just the server specified.

```
$ enstore start --just log_server
Checking log_server.
Starting log_server: 131.225.84.1:7504
```

--nocheck
Assumes that the servers are already down. This speeds startup if it is already known that the servers will not still be running. Used by **`enstore restart`**.

3.22 enstore stop

Without any switches or arguments, this stops most Enstore processes on the current host. See also **`enstore start`** and **`enstore restart`**.
Syntax:
`% enstore stop [--options [arguments] ...]`
Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

```
$ enstore stop --help
Usage:
       restart [ -h --all --help --just= --usage ]

       --all                 specify all servers
   -h, --help                prints this messge
       --just <SERVER NAME>  specify single server
       --usage               prints short help message
```

--all
Stop all Enstore processes on the current host. This includes the `monitor server` and `pnfs_agent` excluded by the default list without any switches or arguments.

--just <SERVER_NAME>
Stop just the server specified.

```
$ enstore stop --just log_server
Checking log_server.
Stopping log_server: 131.225.84.1:7504
Stopped log_server.
```

3.23 enstore system

Updates the Status at a Glance page and System Summary web pages.
Syntax:
```
% enstore system [--options [arguments] ...]
```
Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

```
$ enstore system --help
Usage:
       system [ -h --help --usage ]

   -h, --help                prints this messge
       --usage               prints short help message
```

3.24 enstore up_down

Syntax:
```
% enstore up_down [--options [arguments] ...]
```
Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

```
$ enstore up_down --help
Usage:
       up_down [ -h --help --make-html --no-mail --summary --usage ]

   -h, --help                prints this messge
       --make-html           format output as html
       --no-mail             do net send e-mail in case of errors
       --summary             print (stdout) server states
       --usage               prints short help message
```

--make-html

--no-mail

--summary

3.25 enstore volume

Syntax:
```
% enstore up_down [--options [arguments] ...]
```
Options:

-h, --help
Prints the options (i.e. Prints this message). Example:

$ enstore volume --help

```
Usage:
       vol [OPTIONS]...

       --VOL1OK              reset cookie to '0000_000000000_0000001'
       --add <VOLUME_NAME> <LIBRARY> <STORAGE_GROUP> <FILE_FAMILY> <WRAPPER>
            <MEDIA_TYPE> <VOLUME_BYTE_CAPACITY> [REMAINING_BYTES]  declare a
                             new volume
   -a, --alive               prints message if the server is up or down.
       --all                 used with --restore to restore all
       --assign-sg <STORAGE_GROUP> <VOLUME_NAME>  reassign to new storage
group
       --backup              backup voume journal -- part of database backup
       --bypass-label-check  skip syntatical label check when adding new
                             volumes
       --check <VOLUME_NAME>  check a volume
       --clear <VOLUME_NAME>  clear a volume
       --clear-sg            used with recycle to clear storage group
       --decr-file-count <COUNT>  decreases file count of a volume
       --delete <VOLUME_NAME>  delete a volume
       --do-alarm <DO_ALARM>  turns on more alarms
       --do-log <DO_LOG>     turns on more verbose logging
       --do-print <DO_PRINT>  turns on more verbose output
       --dont-alarm <DONT_ALARM>  turns off more alarms
       --dont-log <DONT_LOG>  turns off more verbose logging
       --dont-print <DONT_PRINT>  turns off more verbose output
       --erase <VOLUME_NAME>  erase a volume
       --export <VOLUME_NAME>  export a volume
       --forget-all-ignored-storage-groups  clear all ignored storage groups
       --forget-ignored-storage-group <STORAGE_GROUP>  clear a ignored
storage
                             group
       --full <VOLUME_NAME>  set volume to full
       --get-sg-count <LIBRARY> <STORAGE_GROUP>  check allocated count for
                             lib,sg
       --gvol <VOLUME_NAME>  get info of a volume in human readable time
                             format
   -h, --help                prints this messge
       --history <VOLUME_NAME>  show state change history of volume
       --ignore-storage-group <STORAGE_GROUP>  ignore a storage group. The
                             format is "<library>.<storage_group>"
       --import <EXPORTED_VOLUME_OBJECT>  import an exported volume object.
                             The file name is of the format
"vol.<volume_name>.obj"
       --just                used with --pvols to list problem
       --keep-declaration-time  keep declared time when recycling
       --labels              list all volume labels
       --list <VOLUME_NAME>  list the files in a volume
       --ls-active <VOLUME_NAME>  list active files in a volume
       --ls-sg-count         list all sg counts
       --migrated <VOLUME_NAME>  set volume to MIGRATED
       --modify <VOLUME_NAME>  modify a volume record -- extremely dangerous
       --new-library <LIBRARY>  set new library
       --no-access <VOLUME_NAME>  set volume to NOTALLOWED
       --not-allowed <VOLUME_NAME>  set volume to NOTALLOWED
       --pvols               list all problem volumes
       --read-only <VOLUME_NAME>  set volume to readonly
       --rebuild-sg-count    rebuild sg count db
       --recycle <VOLUME_NAME>  recycle a volume
       --reset-lib <LIBRARY>  reset library manager
       --restore <VOLUME_NAME>  restore a volume
       --retries <ALIVE_RETRIES>  number of attempts to resend alive requests
       --set-comment <COMMENT> <VOLUME_NAME>  set comment for a volume
       --set-sg-count <LIBRARY> <STORAGE_GROUP> <COUNT>  set allocated count
                             of lib,sg
       --show-ignored-storage-groups  show all ignored storage group
       --show-quota          show quota information
```

--VOL1OK
Used in conjunction with --add. This modifier lets Enstore know that the volume will have an ANSI VOL1 label already written on the media. If there is not a VOL1 label already on the volume do not use this switch.

--add <VOLUME_NAME> <LIBRARY> <STORAGE_GROUP> \
<FILE_FAMILY> <WRAPPER> \
<MEDIA_TYPE> <VOLUME_BYTE_CAPACITY> \
[REMAINING_BYTES]
Used to declare a new volume to Enstore. The VOLUME_NAME, LIBRARY, and MEDIA_TYPE need to be set when this command is executed. The LIBRARY, STORAGE_GROUP, FILE_FAMILY AND WRAPPER can in any combination be set to their correct value or the string "none" (without the double quotes). The LIBRARY value, when specified, needs to match the short name (without the trailing .library_manager) of the library it will belong to. The MEDIA_TYPE must match a media type defined in the **blocksizes** section of the configuration file (see section ?).

```
$ enstore volume --add TS0001 none none none none LTO 800G
```

See --vol or --gvol for the example to show the meta data for TS0001.

--all

--assign-sg <STORAGE_GROUP> <VOLUME_NAME>
Specify a new storage group for this volume. See also --new-library.

```
$ enstore volume --assign-sg new_sg NULL01
BAD STATUS ('V-ERROR', 'can not reassign from existing storage group zee')
```

--backup
Backup the volume journal.

```
$ enstore volume --backup
```

--bypass-label-check
Used with --add to skip the check if a volume name is valid. The format of a valid ANSI label in this exact order is:

1. 2 Alphabetical characters
2. 2 Alphanumeric characters
3. 2 Numeric characters
4. For LTO tapes in ADIC robots only, an appended L1 or L2.

The following example shows an 'illegal' label name being defined; the fifth character in the label is alphabetical not numeric.

```
$ enstore volume –add STORM1 none none none none LTO 100G \
--bypass-label-check
```

--check <VOLUME_NAME>
Output the current status of the volume. This output puts everything on one line, instead of multiple lines like --vol, --gvol does.

```
$ enstore vol --check TEST01
TEST01       60.14GB ['NOTALLOWED', 'none'] ['none', 'none']
```

The contents of the output are:

1. The volume name.
2. The unused bytes renaming on the volume.
3. The pair of system inhibits.
4. The pair of user inhibits.

--clear <VOLUME_NAME> [system_inhibit | user_inhibit <1 | 2>]
Clear the any system inhibit on the volume. By default “system_inhibit 1” is assumed if not specified.
Example to clear NOTALLOWED or NOACESS system inhibits on the volume.

```
$ enstore vol--check TEST01
TEST01       60.14GB ['NOTALLOWED', 'none'] ['none', 'none']
$ enstore vol --clear TEST01

$ enstore vol --check TEST01
TEST01       60.14GB ['none', 'none'] ['none', 'none']
```

Example to clear full or readonly system inhibits on the volume:

```
bash-3.00$ enstore vol --check TEST04
TEST04       59.82GB ['none', 'full'] ['none', 'none']
bash-3.00$ enstore vol --clear TEST04 system_inhibit 2

bash-3.00$ enstore vol --check TEST04
TEST04       59.82GB ['none', 'none'] ['none', 'none']
```

--clear-sg
Used with --recycle to clear the storage group. This will allow the volume to be placed into the common blank pool for any experiment to use.

--decr-file-count <COUNT>

--delete <VOLUME_NAME>
Delete a volume. The volume must contain only files that are marked deleted. If the volume contained zero files on it, the volume is totally removed from the system. If the volume contained files, then the volume is renamed to have .deleted appended to it. To remove a .deleted file see --erase.
First the empty volume example:

```
$ enstore volume --check TEST01
TEST01      1000.00GB ['none', 'none'] ['none', 'none']
$ enstore volume --delete TEST01

$ enstore volume --check TEST01
BAD STATUS ('NO SUCH VOLUME', 'Info Clerk: no such volume TEST01')
$ enstore volume --check TEST01.deleted
BAD STATUS ('NO SUCH VOLUME', 'Info Clerk: no such volume TEST01.deleted')
```

Here is the non-empty volume example:

```
$ enstore volume --check TEST02
TEST02      1000.00GB ['none', 'none'] ['none', 'none']
$ enstore volume --delete TEST02

$ enstore volume --check TEST02.deleted
TEST02.deleted    60.32GB ['DELETED', 'none'] ['none', 'none']
```

--erase <VOLUME_NAME>
Remove a .deleted volume from the system. This command is used after --delete or --recycle.

```
$enstore volume –check TEST02.deleted
TEST02.deleted    60.32GB ['DELETED', 'none'] ['none', 'none']
$ enstore volume –erase TEST02.deleted

$ enstore volume --check TEST02.deleted
BAD STATUS ('NO SUCH VOLUME', 'Info Clerk: no such volume TEST02.deleted')
```

--export <VOLUME_NAME>

--forget-all-ignored-storage-groups

--forget-ignored-storage-group <STORAGE_GROUP>

--full <VOLUME_NAME>
Set the specified volume's status to full.

```
$ enstore volume --check STORM3
STORM3       59.82GB ['none', 'none'] ['none', 'none']
$ enstore volume --full STORM3

$ enstore volume --check STORM3
STORM3       59.82GB ['none', 'full'] ['none', 'none']
```

--get-sg-count <LIBRARY> <STORAGE_GROUP>
Lists the number of volumes belonging to the indicated library and storage group pairing. This as the the same functionality as **enstore info --get-sg-count**.

```
$ enstore volume –get-sg-count LTO3 test
       rain             zee         3
```

--gvol <VOLUME_NAME>
Similar to --vol, but the time values are converted to human readable strings instead of seconds from the beginning of the epoch.

```
$ enstore volume --gvol VO2345
{'blocksize': 131072,
 'capacity_bytes': 214748364800L,
 'comment': '',
 'declared': 'Fri Aug  3 08:42:35 2007',
 'eod_cookie': '0000_000000000_0000130',
 'external_label': 'VO2345',
 'first_access': 'Tue Aug 28 07:09:39 2007',
 'last_access': 'Tue Aug 28 09:29:07 2007',
 'library': 'CD-9940B',
 'media_type': '9940B',
 'remaining_bytes': 134423138304L,
 'si_time': ('Wed Dec 31 18:00:00 1969', 'Tue Jul 17 02:56:42 2007'),
 'sum_mounts': 51,
 'sum_rd_access': 0,
 'sum_rd_err': 0,
 'sum_wr_access': 129,
 'sum_wr_err': 0,
 'system_inhibit': ['none', 'none'],
 'user_inhibit': ['none', 'none'],
 'volume_family':
'minos.mcout_cedar_phy_near_daikon_00_L010170N_cand.cpio_odc',
 'wrapper': 'cpio_odc',
 'write_protected': 'n'}
```

--history <VOLUME_NAME>
Output the inhibit changes for the volume.

```
$ enstore volume --history BZG023
2008-02-11 13:19:17.892302   system_inhibit[0]    none
2008-02-11 13:18:17.22456    system_inhibit[1]    full
2007-09-18 14:17:05.716276   system_inhibit[0]    none
2007-07-18 15:16:37.713169   system_inhibit[0]    NOACCESS
2007-01-31 10:25:22.996649   system_inhibit[0]    none
2007-01-31 10:15:26.246705   system_inhibit[0]    NOACCESS
```

--ignore-storage-group <STORAGE_GROUP>

--import <EXPORTED_VOLUME_OBJECT>

--just

--keep-declaration-time
Keep the current declaration time when recycling a volume. See also --recycle.

--labels
List all volume names.

```
$ enstore volume --labels | head
```

```
NUL001
NUL002
NUL003
NUL004
NUL005
NUL006
NUL007
NUL008
NUL009
NUL010
```

--migrated <VOLUME_NAME>

--modify <VOLUME_NAME>
Powerful command to modify all database fields (except volume names). See --vol or --gvol for examples of outputting the contents of these changes. Example to reset the comment field:

```
$ enstore volume --modify TEST03 'comment=""'
```

Example to reset the system inhibit:

```
$ enstore volume –modify TEST03 \
“system_inhibit=['none', 'full']"
```

--new-library <LIBRARY>

--no-access <VOLUME_NAME>
Synonym for --not-allowed.

--not-allowed <VOLUME_NAME>
Set the volume system inhibit to NOTALLOWED.

```
$ enstore volume --check TZ4562
TZ4562       59.82GB ['none', 'full'] ['none', 'none']
bash-3.00$ enstore volume --not-allowed TZ4562

bash-3.00$ enstore volume --check TZ4562
TZ4562       59.82GB ['NOTALLOWED', 'full'] ['none', 'none']
```

--read-only <VOLUME_NAME>
Set the specified volume's status to readonly.

```
$ enstore volume --check TZ4562
TZ4562       59.82GB ['none', 'none'] ['none', 'none']
$ enstore volume --full TZ4562

$ enstore volume --check TZ4562
TZ4562       59.82GB ['none', 'readonly'] ['none', 'none']
```

--rebuild-sg-count

--recycle <VOLUME_NAME>
Rename the current volume by VOLUME_NAME to VOLUME_NAME.deleted. Then declare a new VOLUME_NAME volume while preserving information like mount and access counts. See also --clear-sg and --keep-declaration-time.

```
$enstore volume --recycle JK4562
```

--reset-lib <LIBRARY>

--restore <VOLUME_NAME>

--set-comment <COMMENT> <VOLUME_NAME>
Set the comment field for a volume.

```
$ enstore volume --vol GR4444 | grep comment
 'comment': '',
$ enstore volume --set-comment "Possible issue at location 42." GR4444

$ enstore volume --vol GR4444 | grep comment
 'comment': 'Possible issue at location 42.',
```

To reset the comment back to being emtpy some care needs to be used to avoid the shell eating the double quotes.

```
$ enstore volume --set-comment \"\" GR4444
```

--set-sg-count <LIBRARY> <STORAGE_GROUP> <COUNT>

--show-ignored-storage-groups

--show-quota

--show-state
Show the internal state of the volume clerk.

--trim-obsolete <VOLUME_NAME>

--write-protect-off <VOLUME_NAME>
Set the write protect tab state to off for the specified volume. See also --write-protect-on and --write-protect-status.

--write-protect-on <VOLUME_NAME>
Set the write protect tab state to on for the specified volume. See also --write-protect-off and --write-protect-status.

--write-protect-status <VOLUME_NAME>
Show the write protect tab state for the specified volume. See also --write-protect-off and --write-protect-on.

```
$ enstore volume --write-protect-status GAME42
GAME42 write-protect OFF
$ enstore volume --write-protect-on GAME42
$ enstore volume --write-protect-status GAME42
GAME42 write-protect ON
$ enstore volume --write-protect-off GAME42
$ enstore volume --write-protect-status GAME42
GAME42 write-protect OFF
```

Chapter 4: Migration and Duplication

Migration is the task of reading files from one tape then writing them onto another tape with the intend of replacing the original. Usually this is to put them on newer tapes, typically using newer tape technology.

Duplication reads original files and instead of replacing the old copies makes the newly written copies a duplicate[1] of the original.

Cloning via migration occurs when the source media type and destination media type are the same.

There are four stages recorded in the progress of file migration or duplication. These states are recored in the `migration` table in the Enstore DB.

- **Copied** – the original file(s) has been read from the source tape and written to the new tape.
- **Swapped**
  - Migration – The meta data has been swapped. This means that the new copy is the one users see from PNFS.
  - Duplication – The new file's meta data has be recorded as a duplicate of the original file.
- **Checked** – The new copy on the new tape has been read to verify that everything went correctly with reading and writing the file.
- **Closed** – The file copying and verification is done.

See the `--status` switch for information on these states. If the file copying becomes interrupted; it can safely be restarted and it will pick up where it left off.

There are three times that a volume's meta data are modified:

13. The original volume is set to **migrating**, **duplicating** or **cloning** when the first file is attempted to be migrated, duplicated or cloned via migration. This is to prevent additional files being written to the volume while it is being copied.
14. After all files on a original volume are copied and swapped:
    1. The original volume's meta data has its system inhibit set to **migrated**, **duplicated** or **cloned**.
    2. The original volume's comment is set to record the volumes the files were migrated or duplicated onto.
15. After all the files on the destination volume are copied, swapped, checked and closed:
    1. The comment of the new tape is set to recored the volume list

1 Encp can make multiple copies (A.K.A. duplicates) of files using the `--copies` switch. Duplication, as described here, mimics this feature of encp.

that the files were migrated or duplicated from.

2. The `migration_history` is updated to record the original volume, destination volume and the time stamp this was completed.
3. For migration only: The file_family is set to the non-migration mangled file family. Duplication leaves this value alone because it has already been set to the correct multiple copy mangled file family.

There are three modes to migration or duplication:

12. Copying a list of files. Internally, it is converted to a list of bfids.
13. Copying a list of bfids.
14. Copying all the files on a list of volumes.

Migrating or duplicating an entire volume's worth of files at one time is usually more efficient.

4.1 Preparation

Before migrating or duplicating files the following steps are recommended.

- Check that `/pnfs/fs/` is mounted on the node the migration or duplication will be run on. If multiple PNFS installations are present, make sure the correct one is currently mounted.
- Check that the pnfs tags in the `/pnfs/fs/usr/Migration` directory contain the correct values. It is strongly recommended that this directory be its own PNFS database.
- Use the **enstore info --show-bad** command to identify any files that will be expected to be unreadable.
- Use the **enstore scan** command to check the meta data of the source bfids, files or volumes.

4.2 Migration

4.2.1 Reasons for migration

Three main reasons exist for migrating data to new tapes.

- Using denser media with faster tape drives.
- Data compaction or “squeezing” of active data files to free up space occupied by deleted files.
- The tape a file(s) is currently on is no longer reliable.

4.2.2 Migration command

Syntax, as root:

```
# migrate [ --option [argument] ...] [target_list]
# migrate [ --option [argument] ...] [media_type
[library [storage_group [file_family [wrapper]]]]]
# migrate --restore [target_list]
# migrate --scan [target_list]
```

Syntax, as any user:

```
% migrate --status [target_list]
% migrate --migrated-from <volume_list>
% migrate --migrated-to <volume_list>
```

The target list can be volume labels, BFIDs or file names in any order in any combination. Internally, file names are converted to BFIDs. All BFIDs are processed before volumes.

Here is an example of the primary use of this command to migrate three volumes worth of files to new media.[2]

```
# migrate --spool-dir /data/data2/Migration_Spool VO0000
VO0001 VO0002
```

A return code of zero (0) indicates success migrating all files (or volumes) in the argument list.

A volume that has been migrated will have its status set to reflect that it has been migrated. The following shows that OLD000 has been migrated to NEW001. **Note:** The comment contains the string "<=" or "=>". This indicates migration was done. If duplication were performed, this string would be "->" or "<-" instead. **Note**: A volume's comment field can be changed at any time; especially if a problem with the tape arises. This clobbering means that this can not be the only means used to determine if a volume contains migrated (or duplicated) files.

```
$ enstore info --vol OLD000 | egrep "comment|system_inhibit"
 'comment': '=> NEW001',
 'system_inhibit': ['none', 'migrated'],
$ enstore info --vol NEW001 | egrep "comment|system_inhibit"
 'comment': '<= OLD000',
 'system_inhibit': ['none', 'none'],
```

A log of the migration, everything set to standard out, is also sent to: /var/migration/MigrationLog@<timestamp>#<pid>

2 The sample command has been split onto two lines with the standard shell continuation character (\).

Options:

-h, --help
Prints the options (i. e. Prints this message). Example:

$ migrate --help

```
Usage:
       migrate [OPTIONS]... [bfid1 [bfid2 [bfid3 ...]]] | [vol1 [vol2
[vol3 ...]]] | [file1 [file2 [file3 ...]]] | [vol1:lc1 [vol2:lc2
[vol3:lc3 ...]]]
       migrate [OPTIONS]... [media_type [library [storage_group [file_family
[wrapper]]]]]
       migrate [OPTIONS]... --restore [bfid1 [bfid2 [bfid3 ...]] | [vol1
[vol2 [vol3 ...]]] | [file1 [file2 [file3 ...]]] | [vol1:lc1 [vol2:lc2
[vol3:lc3 ...]]]
       migrate [OPTIONS]... --scan [bfid1 [bfid2 [bfid3 ...]] | [vol1 [vol2
[vol3 ...]]] | [file1 [file2 [file3 ...]]] | [vol1:lc1 [vol2:lc2
[vol3:lc3 ...]]]
       migrate [OPTIONS]... --migrated-from <vol1 [vol2 [vol3 ...]]>
       migrate [OPTIONS]... --migrated-to <vol1 [vol2 [vol3 ...]]>
       migrate [OPTIONS]... --status [bfid1 [bfid2 [bfid3 ...]]] | [vol1
[vol2 [vol3 ...]]] | [file1 [file2 [file3 ...]]] | [vol1:lc1 [vol2:lc2
[vol3:lc3 ...]]]
       migrate [OPTIONS]... --show <media_type> [library [storage_group
[file_family [wrapper]]]]]


       --destination-only    Used with --status to only list output assuming
                              the volume is a destination volume.
       --file-family <FILE_FAMILY>  Specify an alternative file family to
                              override the pnfs file family tag.
   -h, --help                prints this message
       --infile <INFILE>     Read target list of bfids, volumes,
                             volume:location_cookie pairs or paths from file.
                              Types can be intermixed.
       --library <LIBRARY>   Specify an alternative library to override the
                              pnfs library tag.
       --migrated-from       Report the volumes that were copied to this
                              volume.
       --migrated-to         Report the volumes that were copied from this
                              volume.
       --migration-only      Used with --status to only list output assuming
                              the target is not orhas not a multiple copy.
       --multiple-copy-only  Used with --status to only list output assuming
                              the target is orhas a multiple copy.
       --priority <PRIORITY>  Sets the initial job priority.  Only
                              knowledgeable users should set this.
       --read-to-end-of-tape  Read to end of tape before starting to write.
       --restore             Restores the original file or volume.
       --scan                Scan completed volumes or individual bfids.
       --show <MEDIA_TYPE> [LIBRARY] [STORAGE_GROUP] [FILE_FAMILY] [WRAPPER]
                             Report on the completion of volumes.
       --skip-bad            Skip bad files.
       --source-only         Used with --status to only list output assuming
                              the volume is a source volume.
       --spool-dir <SPOOL_DIR>  Specify the directory to use on disk.
       --status              Report on the completion of a volume.
                             S = State of duplication:
                                 P = Primary/original copy; duplication
                                 C = Muliple copy; duplication
                                 O = Original/primary copy
                                 M = Multiple copy
                             D = Deleted state:
                                 N = Not deleted
                                 Y = Yes deleted
```

```
                              U = Unknown; failed write
                           B = Bad file
                              B = Bad file
                              E = Empty metadata fields
      --usage              prints short help message
      --use-disk-files     Skip reading files on source volume, use files
                            already on disk.
      --use-volume-assert  Use volume assert when scanning destination
                            files.
      --with-deleted       Include deleted files.
      --with-final-scan    Do a final scan after all the files are recopied
                            to tape.
```

--destination-only
Used with --status to report the requested targets as source volumes or BFIDs. See also --source-only and --status.

--duplication-only
Used with --status to report duplication only. See also --duplication-only, --multiple-copy-only and --status.

--file-family <FILE_FAMILY>
This switch overrides the original file family. This is typically used to combine a number of smaller file families into one while squeezing a few small capacity tapes onto new larger capacity tapes. This can help improve file density by not wasting space on tapes.

--library <LIBRARY>
This switch overrides the PNFS library tag when writing the new copy.

It is permissible to specify a comma separated list of libraries, without any whitespace. This will make additional multiple copies using the **encp --copies** functionality.

--migrated-from <VOLUME_LIST>
Report on the list of volumes whose files to which files were migrated to the requested volumes. This information does not come from the volumes comment field; it is determined from the Enstore DB.

```
$ migrate --migrated-from PSA423 PSA403

PSA423 <= PRU482L1 PRV397L1
PSA403 <= PRV033L1 PRV034L1
```

See `--migrated-to` for information in the other direction.

--migrated-to <VOLUME_LIST>
Report on the list of volumes whose files to which files were migrated from the requested volumes. This information does not come from the volumes comment field; it is determined from the Enstore DB.

```
$  migrate --migrated-to PRV397L1 PRV034l1

PRV397L1 => PSA423
PRV034l1 =>
```

See `--migrated-to` for information in the other direction.

--migration-only
Used with --status to report migration and cloning only. See also --destination-only, --multiple-copy-only and --status.

--multiple-copy-only
Used with --status to report copies made by **encp** only and from duplication. See also --destination-only, --migration-only and --status.

--priority <PRIORITY>
The default priority for a migration **encp** is zero. This is lower than the default priority of one for a typical **encp**. Use of this switch allows the user to override the default to give this migration a higher priority.

--read-to-end-of-tape
Do not start writing files to the destination volume, until all source files have been read from the source volume.

--restore <VOLUME_LIST> | <BFID_LIST> | <FILENAME_LIST>
After the swap step, the PNFS meta data points to the newly written copy of the file. This command resets the PNFS meta data to point to the original copy on the original tape, mark the old copy as undeleted, mark the new copy as deleted and removes the temporary PNFS file from underneath `/pnfs/fs/usr/Migration/`. If a volume was the target, then it also resets the original volumes comment and system inhibit values.

```
# migrate --restore TEST01 TEST02
```

. . .

The sequence of commands to undo a volume migration are:
Undo the metadata swap.

```
# migrate --restore <VOLUME_LIST>
```

Purge the BFIDs of the new tape copies from the Enstore (file & volume) database.

- *If all files on the new tape are from volumes that have just been restored.*

```
$ enstore volume --modify <VOLUME> comment="" #Once for each volume.

$ enstore volume --recycle <VOLUME>          #Once for each volume.

$ enstore volume --erase <VOLUME>.deleted    #Once for each volume.
```

The switches--delete and --bfid could be used instead of --recycle; if so then the -- modify command would be skipped.

- *If all files on the new tape are **not** from volumes that have just been*

restored.

```
$ enstore file --erase <BFID>     #Once for each bfid.
```

If a file on a newly migrated to volume is found to be unreadable; then you can do the following:

Verify the bfid for the bad file.

```
# migrate --status TST982L1 | grep -A 2 -B 2
D0MS113811445800000

D0MS113811429500000 D0MS122085462500000      y      y      y      y
D0MS113811438100000 D0MS122085470200000      y      y      y      y
D0MS113811445800000 D0MS122085478000000      y      y
D0MS113811454200000 D0MS122085481800000      y      y
D0MS113811462400000 D0MS122085487200000      y      y
```

Undo the metadata swap for the unreadable file.

```
# migrate --restore D0MS113811445800000

Wed Oct  1 14:45:07 2008 MIGRATION migrate --restore D0MS113811445800000
Wed Oct  1 14:45:08 2008 RESTORE D0MS113811445800000 has already been marked
undeleted ... OK
Wed Oct  1 14:45:08 2008 RESTORE set D0MS122085478000000 deleted ... OK
```

Verify that there is no longer a destination bfid paired with the source bfid.

```
# migrate --status TST982L1 | grep -A 2 -B 2
D0MS113811445800000

D0MS113811429500000 D0MS122085462500000      y      y      y      y
D0MS113811438100000 D0MS122085470200000      y      y      y      y
D0MS113811445800000
D0MS113811454200000 D0MS122085481800000      y      y
D0MS113811462400000 D0MS122085487200000      y      y
```

Remigrate the file.

--scan <VOLUME_LIST> | <BFID_LIST> | <FILENAME_LIST>

This switch closes out the migration status of the specified target files or volumes. The volumes or bfids supplied need to be a destination target. If a file on a tape is found to be unreadable or corrupted, it is not marked as checked and the migration status of the volume, if applicable, will not be updated.

If a volume was not migrated with the –with-final-scan switch enabled; then the files on these volumes will be read to verify that everything is correct. If –with-final-scan was enabled (and the files passed); then the files are marked closed and the volumes have their migration status updated.

```
$ migrate --scan PSA000 PSA001
...
```

If a specific set of files are listed by their bfid, only those files are scanned. If all the remaining bfids on a volume are supplied and they all scan successfully the volume metadata is still left alone. This could be useful in

scanning the files from a particular source volume, while leaving the destination volume available for more migrated files to be written to it.

--source-only
Used with --status to report the requested targets as source volumes or BFIDs. See also --destination-only and --status.

--spool-dir <SPOOL_DIR>
Specify the spool directory where the files are read from the original tape, before they are written to the new tape.

--status <VOLUME_LIST> | <BFID_LIST> | <FILENAME_LIST>
Report on the current status of the requested volumes, file names or bfids. The volumes specified can be either an original volume or a new volume.

```
$ migrate --status TST397L1
```

```
(TST397L1) src_bfid SDB            dst_bfid SDB copied swapped checked closed
D0MS120685047500000 PN  D0MS121088793700000 CN       y      y      y
D0MS120688739300000 PN  D0MS121088795600000 CN       y      y      y
D0MS120692204400001 PN  D0MS121088798600000 CN       y      y      y
D0MS120730702700000 PN  D0MS121088812000000 CN       y      y      y
D0MS120730706700000 PN  D0MS121088822600000 CN       y      y      y
D0MS120730709100000 PN  D0MS121088836900000 CN       y      y      y
D0MS120730711900000 PN  D0MS121088849400000 CN       y      y      y
D0MS120730716200000 PN  D0MS121088867100000 CN       y      y      y
D0MS120744939400000 CN  D0MS121088874500000 PN       y      y      y
D0MS120744941400000 CN  D0MS121088887000000 PN       y      y      y
D0MS120744961000000 CN  D0MS121088904000000 PN       y      y      y
D0MS120753217600000 CN  D0MS121096722600000 PN       y      y      y
D0MS120753222200000 CN  D0MS121096725100000 PN       y      y      y
D0MS120753229700000 CN  D0MS121096728100000 PN       y      y      y
D0MS120753229700000 YE

DUPLICATION
```

The left BFID is the source BFID; while the right BFID is the destination BFID. In the above example the “y”s indicate that the files have been copied, swapped and checked.; but not closed. This would indicate that the --`with-final-scan` switch was used and --`scan-volumes` has not been used yet.

At the end of the output it is reported that duplication was used. The list of valid values that can be appear here is: **DUPLICATION**, **MIGRATION**, **CLONING** or left blank.

Each BFID has a three columns of additional information:
S columns:

For migration they would be left blank.

For duplication a **P** indicates it is the primary copy of the file and a **C** indicates it is a multiple copy from a duplication. They

appear immediately after the BFID located on the volume specified on the command line. In the above example, the volume on the command line was the source volume and that the first 8 files are primary copies, while the rest are multiple copies. See the section on swap_original_and_copy.py for more information on primary versus multiple copy files.

A value of **M** represents a multiple copy and **O** represents an original copy. These are different from P and C, since M and O were created using the multiple copy feature of **encp** outside of any duplication effort. If migration is used to make multiple destination copies, then the --status output will include multiple entries for each source bfid.

D columns: These columns report if the associated source and destination BFIDs are marked deleted (**Y**) or not marked deleted (**N**) in the database. A **U** value is possible for a file on a destination volume when the file is the result of a failed transfer.

B columns: These columns indicate if the file has been marked bad using the `enstore file --mark-bad` command; such files are reported with a **B**. An **E**, for empty, will appear here if the file record is missing information, like the pnfs id and pnfs path name, indicating that the file was a failed transfer.

Here is another use of `--status` that can be used to report if the a volume is done or not. The success return code (0) means that the volume is done; while the error return code (1) indicates that it is not completed.

```
$ migrate --status PSA003 > /dev/null; echo $?
0
$ migrate --status PSA004 > /dev/null; echo $?
1
```

See also --destination-only, --duplication-only, --migration-only, --multiple-copy-only and --source-only.

--use-disk-files
Use the files already located in the spool directory to write to the new tape. The file names must have the format <volume>:<location_cookie> and refer the correct location on the original source tape. All files need to be present in the spool directory. All unreadable files need to be marked as bad using the **enstore file --mark-bad <path> [bfid]** command.

The intended purpose is to allow for tapes that are sent to a vendor for data

recovery (and are returned with files in different locations on the tape) to still be migrated. The readable files need to be read using UNIX tools, like **dd**, to dump the files.

--with-deleted
This switch tell the migration process that deleted files on the original volumes are to be migrated too. These files are migrated to a different volume then their non-deleted counterparts. This allows for tapes to be squeezed while still isolating the files that are likely not to be considered important. Volumes containing deleted migrated files have "DELETED_FILES" at the beginning of their file family.

--with-final-scan
After the file meta data has been swapped for all the files on the tape; re-read all the migrated files on the new volume or volumes. If a file was skipped because it was not yet copied or swapped; it will not be marked as checked either. If this switch is used at the time of migration, then they will not been to be re-read when `--scan-volumes` is used to close the migration of the specified volumes.

In general, it is more efficient to use this switch when only copying a single volume's worth of files or a list of individual files. If multiple volumes are being copied using this switch is not recommended.

See `--scan-volumes`.

4.2.3 Migration file_family mangling

The file family of a destination migration volume is appended with **-MIGRATION**. This is to force the migration files onto specific tapes separate than those for general users to write to. This keeps other requests from interweaving themselves between migration requests. After all the volumes are successfully scanned, the file family is set back to the file family of the original volume.

For deleted files when using `--with-deleted`, the original volumes file_family is ignored and the special file_family **DELETED_FILES** is used instead. The -MIGRATION is still appended while the volume is being migrated.

4.3 Duplication

The process of duplication is very similar to that of migration. The differences include:

- The volume comments indicating that a volume has been migrated from or migrated to will be “<-” or “->” instead of “<=” or “=>”.
- The swap step is not a complete swap of meta data like it is in migration. Instead it registers the new file to be a multiple copy of the original.
- The duplication log goes to: /var/duplication/DuplicationLog@<timestamp>#<pid>
- The file family is mangled by appending _copy_1 instead of -MIGRATION. See section 1.2.2 for more information.

4.3.1 Reasons for duplication

Duplication is usually preferred over migration when:

5. A second copy of the files on tapes is desired in a new tape library. If both tape libraries exist at the time encp is executed by the user, then using the multiple copy feature of encp is recommended. Typically, the second copy will be in a separate location from the original.
6. When a multiple copy write fails, but the original succeeded, a entry is left in the active_file_copying table of the Enstore (file & volume) database. Duplication is needed to make the second copy of these files.

4.3.2 Duplication command

Here is an example of the primary use of this command to duplicate three volumes worth of files to new media.[3]

```
# duplicate --spool-dir /data/data2/Migration_Spool VO0000
VO0001 VO0002
```

A return code of zero (0) indicates success duplicating all files (or volumes) in the argument list.

```
$ duplicate --help
Usage:
       duplicate [OPTIONS]... [bfid1 [bfid2 [bfid3 ...]]] | [vol1 [vol2 [vol3
...]]] | [file1 [file2 [file3 ...]]] | [vol1:lc1 [vol2:lc2 [vol3:lc3 ...]]]
       duplicate [OPTIONS]... [media_type [library [storage_group
[file_family [wrapper]]]]]
       duplicate [OPTIONS]... --restore [bfid1 [bfid2 [bfid3 ...]] | [vol1
[vol2 [vol3 ...]]] | [file1 [file2 [file3 ...]]] | [vol1:lc1 [vol2:lc2
[vol3:lc3 ...]]]
       duplicate [OPTIONS]... --scan [bfid1 [bfid2 [bfid3 ...]] | [vol1 [vol2
[vol3 ...]]] | [file1 [file2 [file3 ...]]] | [vol1:lc1 [vol2:lc2
[vol3:lc3 ...]]]
       duplicate [OPTIONS]... --migrated-from <vol1 [vol2 [vol3 ...]]>
       duplicate [OPTIONS]... --migrated-to <vol1 [vol2 [vol3 ...]]>
       duplicate [OPTIONS]... --status [bfid1 [bfid2 [bfid3 ...]]] | [vol1
[vol2 [vol3 ...]]] | [file1 [file2 [file3 ...]]] | [vol1:lc1 [vol2:lc2
[vol3:lc3 ...]]]
```

3 The sample command has been split onto two lines with the standard shell continuation character (\).

```
       duplicate [OPTIONS]... --show <media_type> [library [storage_group
[file_family [wrapper]]]]]


       --destination-only    Used with --status to only list output assuming
                              the volume is a destination volume.
       --file-family <FILE_FAMILY>  Specify an alternative file family to
                              override the pnfs file family tag.
   -h, --help                prints this message
       --infile <INFILE>     Read target list of bfids, volumes,
                              volume:location_cookie pairs or paths from
file.
                              Types can be intermixed.
       --library <LIBRARY>   Specify an alternative library to override the
                              pnfs library tag.
       --make-copies <MEDIA_TYPE> [LIBRARY] [STORAGE_GROUP] [FILE_FAMILY]
                     [WRAPPER]  Make copies of the supplied volume group.
       --make-failed-copies  Make duplicates where the multiple copy write
                              failed.
       --migrated-from       Report the volumes that were copied to this
                              volume.
       --migrated-to         Report the volumes that were copied from this
                              volume.
       --migration-only      Used with --status to only list output assuming
                              the target is not orhas not a multiple copy.
       --multiple-copy-only  Used with --status to only list output assuming
                              the target is orhas a multiple copy.
       --priority <PRIORITY>  Sets the initial job priority.  Only
                              knowledgeable users should set this.
       --read-to-end-of-tape  Read to end of tape before starting to write.
       --restore             Restores the original file or volume.
       --scan                Scan completed volumes or individual bfids.
       --show <MEDIA_TYPE> [LIBRARY] [STORAGE_GROUP] [FILE_FAMILY] [WRAPPER]
                             Report on the completion of volumes.
       --skip-bad            Skip bad files.
       --source-only         Used with --status to only list output assuming
                              the volume is a source volume.
       --spool-dir <SPOOL_DIR>  Specify the directory to use on disk.
       --status              Report on the completion of a volume.
                             S = State of duplication:
                                 P = Primary/original copy; duplication
                                 C = Muliple copy; duplication
                                 O = Original/primary copy
                                 M = Multiple copy
                             D = Deleted state:
                                 N = Not deleted
                                 Y = Yes deleted
                                 U = Unknown; failed write
                             B = Bad file
                                 B = Bad file
                                 E = Empty metadata fields
       --usage               prints short help message
       --use-disk-files      Skip reading files on source volume, use files
                              already on disk.
       --use-volume-assert   Use volume assert when scanning destination
                              files.
       --with-deleted        Include deleted files.
       --with-final-scan     Do a final scan after all the files are recopied
                              to tape.
```

--make-copies <MEDIA_TYPE> [LIBRARY] [STORAGE_GROUP] [FILE_FAMILY] [WRAPPER]
This switch tell duplication to find files in the specified set of volumes, that do not have multiple copies and create multiple copies.

--make-failed-copies
When **encp** succeeds in writing an original copy, but fails to write a multiple

copy a table entry in the `active_file_copying` table in the file and volume database is left indicating how many multiple copies have failed to be written. When duplication is executed with `--make-failed-copies` the input file list to duplicate is chosen from the contents of the `active_file_copying` table.
If this version of duplication is run on a non-admin and non-trusted PNFS filesystem, then the `/pnfs/fs/usr/Migration/` directory is not used and instead `.m.<original_name>` temporary filenames are used.

4.3.3 Duplication file_family mangling

The file family of a destination duplication volume is appended with **_copy_1**. This is to force the duplication files onto specific tapes separate than those for general users to write to. This keeps other requests from interweaving themselves between migration requests. After all the volumes are successfully scanned, the file family is set back to the file family of the original volume.

The purpose of using _copy_1, instead of the more obvious -DUPLICATION, is to mimic the multiple copies feature on encp. Encp can write multiple copies of a file to different volumes using the `--copies` switch.

See the Migration file_family section for more information on the file family when duplicating deleted files.

If --library and --file-family are used together, then some interesting things happen. First, it is possible to end up with files on tapes with file families like **_copy_2**, **_copy_3**, etc. if --library is used with a comma separated list of libraries on the original copy. If duplicating a duplicated file, one with copy1 in the file family already, then the file family would contain **_copy_1_copy_1**. Putting these combinations together does allow for the possibility of trees of multiple copies.

4.4 Swapping metadata

There are two ways to turn migrated files into duplicated files. One way makes the 'original' file copy the multiple copy; the other makes the 'new' file copy the multiple copy. The result of the latter will be the same as if duplication had been used. In addition to this, there is also the ability to swap the files on a duplicated original tapes and the new destination tape. Using the first of the two ways to turn the files on migrated original tape into a duplicated tape followed by a swap will have the same effect as duplication

had been used.

All three of these scripts require them to be run as user root and the /pnfs/fs/usr/... PNFS path be mounted.

4.4.1 make_original_as_duplicate.py

To make the files on the original tape recorded as duplicates in the Enstore database issue the following command:

```
# $ENSTORE_DIR/src/make_original_as_duplicate.py
<original_volume>
```

When this completes successfully the following will have happened:

5. All the successfully migrated files on the original volume will be recorded as duplicates in the file_copies_map table for the new copies on the destination volume(s).
6. The original volume will be marked duplicated instead of migrated or cloned.
7. In PNFS Layer 4 for the file(s) is modified to point to the new copy in the Enstore (file & volume) database.

There are no switches for this command. If the argument list is left blank the help message is printed to the terminal.

The following is a simple example:

```
# $ENSTORE_DIR/src/make_original_as_duplicate.py TEST05
making original TEST05 as copy of the migrated files ...
make_duplicate('WAMS122167084800000', 'WAMS121243218900000') ... OK
make_duplicate('WAMS122167087700000', 'WAMS121243220500000') ... OK
make_duplicate('WAMS122167090800000', 'WAMS121243222200000') ... OK
```

4.4.2 make_migrated_as_duplicate.py

To make the files on the new migrated-to tape recorded as duplicates in the Enstore database issue the following command:

```
# $ENSTORE_DIR/src/make_migrated_as_duplicate.py \
<migrated_to_volume>
```

When this completes successfully the following will have happened:

1. All of the files on the original volume will be recorded as primary copies in the file_copies_map table for the new copies on the destination volume(s).

There are no switches for this command. If the argument list is left blank the help message is printed to the terminal.

The following is a simple example:

```
# $ENSTORE_DIR/src/make_original_as_duplicate.py TEST05

making original TEST05 as copy of the migrated files ...
make_duplicate('WAMS122167084800000', 'WAMS121243218900000') ... OK
make_duplicate('WAMS122167087700000', 'WAMS121243220500000') ... OK
make_duplicate('WAMS122167090800000', 'WAMS121243222200000') ... OK
```

This version does not automatically update the system inhibit to duplicated for the original volume like make_original_as_duplicated.py does. For proper record keeping either use make_original_as_duplicated.py instead of this script or manually modify the system inhibit using the **enstore volume--modify** command.

4.4.3 swap_original_and_copy.py

For duplicated files, it is possible to swap which file is considered the original and which is the duplicate. This can be done for a list of files or for all the files on a list of volumes. The targets must refer to the current primary copy.

```
# $ENSTORE_DIR/src/swap_original_and_copy.py \
[[vol1 [vol2] ...] | [[bfid1 [bfid2] ...]
```

Only duplicated files that have successfully completed the checked phase, meaning they have been scanned, will be allowed to swap.

The following actions are taken on successful completion of this script:

1. All the files that are considered the primary copy are recorded as the the multiple copy in the file_copies_map table in the Enstore (file & volume) database.
2. All the files that are considered the multiple copy are recorded as the primary copy in the file_copies_map table in the Enstore (file & volume) database.
3. PNFS layers 1 and 4 are modified to point to the new primary copy in the Enstore (file & volume) database.
   - The BFID in layer 1
   - The BFID in layer 4
   - The location_cookie in layer 4
   - The original drive in layer 4
   - The file_family in layer 4
4. Only when a **volume** swap is specified:
   - The file_family for the new primary file volume has the _copy_1 removed.
   - The new multiple copy file volume has _copy_# appended to the file family. The # is replaced with the multiple copy count from the file with the most other multiple copies located on other

volumes. In almost all situations this will likely be 1, but greater numbers are possible.

There are no switches for this command. If the argument list is left blank the help message is printed to the terminal.

Here is a simple example:

```
# $ENSTORE_DIR/src/swap_original_and_copy.py TEST06
swapping WAMS122167084800000 ... OK
swapping WAMS122167087700000 ... OK
swapping WAMS122167090800000 ... OK
```

It is possible to swap files back and forth from being the primary copy to a multiple copy. For volumes worth of files, this is done only if **all** files for a volume can be swapped. Thus, it may be easy to swap a volume one direction, but if multiple tapes were duplicated to one destination tape, then the swap back in the reverse direction will fail until all the original volumes are swapped in the first place. If partial volumes swaps are truly needed, consider swapping on a per BFID basis.

There are three ways to able to use this script.

1. After duplication.
2. After migration followed by make_original_as_duplicate.py
3. After migration followed by make_migrated_as_duplicate.py

Note: The file family for the new volume is mangled differently between number 1 than it is for 2 or 3. It may be necessary to manually change it in order to keep everything consistent. No one wants to see an overzealous administrator recycle a volume that really did contain primary copies of files.

It is important to make the distinction between an original copy and primary copy. An original copy is the copy of the file that resides on the first volume that this files was ever written onto. A primary copy is the copy of the file a user will get when they use encp to read a file from tape.

Chapter 5: Cronjobs

A number of cronjobs are considered critical to having a well running Enstore system. These critical cronjobs are delfile.py and enstore system. Most Enstore cronjobs need to run on the same machine as one of the Enstore servers. For example, the pnfs_monitor cronjob needs to run on the PNFS server node.

The name of the subsection refers to the crontab file name in the crontabs directory.

5.1 accounting_db

These cronjobs run on the same machine as the PostgreSQL accounting DB.

5.1.1 db_vacuum.py

Vacuums the accounting DB to shrink the size on disk.

Runs on Host	As User	Runs at
Postgres DB	enstore	4:30am every day

5.2 backup

These cronjobs run on the same machine as the PostgreSQL accounting and drive_stat databases, respectively. This grouping assumes they are running on the same machine.

5.2.1 db_backup.py accounting

Backups the accounting database to the backup node defined in the configuration.

Runs on Host	As User	Runs at
Where the backups go.	enstore	1:10am every day

5.2.2 db_backup.py drive_stat

Backups the drive_stat database to the backup node defined in the configuration.

Runs on Host	As User	Runs at
Where the backups go.	enstore	1:05am every day

5.3 backup2Tape

These cronjobs run on the designated “backup” node in the configuration.

5.3.1 backup2Tape

Backups the Enstore and PNFS databases to tape.

Runs on Host	As User	Runs at
Where the backups go.	enstore	7:30am every day

5.3.2 backupSystem2Tape

Obsolete.

5.4 checkdb

5.4.1 check_db.py

Loads the most recent Enstore (file & volume) database into an offline database server and verifies that all entries are correct. As a side effect, the inventory summary COMPLETE_FILE_LISTING web page is also generated.

Runs on Host	As User	Runs at
Where the backups go.	enstore	Every 2 hours on the 35th minute.

5.5 checkPNFS

These cronjob(s) run on the verify node as defined in the Enstore configuration.

5.5.1 checkPNFS

Verify that the PNFS server is still running.

Runs on Host	As User	Runs at
Where integrity checks are run.	root	Every 10 minutes on the threes.

5.6 chkcrons

These cronjob(s) run on the web server node.

5.6.1 chkcrons.py

Makes the plots of the exits statuses of the other cronjobs.

Runs on Host	As User	Runs at
Where the web server runs.	root	Every 10 minutes on the threes.

5.7 copy_ran_file

These cronjob(s) run on the verify node as defined in the Enstore configuration.

5.7.1 copy_ran_file

Select a random file(s) on a random tape and try to read them back. An exit status of nine (9) on the Cronjob Status plots page indicates that the PNFS mount point(s) are not mounted. An exit status of one (1), two (2) or three (3) means that number of encps failed to run.

copy_ran_file uses choose_ran file to perform the underlying actions. There are a number of switches that can be passed to copy_ran_file or choose_ran_file:

- -x: Enables shell verbose output. Useful for debugging.
- -V: Passes "--verbose 10" to any executed encp processes.
- -C: **choose_ran_file only:** Specifies that the files should not just be randomly chosen, but they should be copied too. copy_ran_file enables this switch when calling choose_ran_file.
- -F: Normally if the library (virtual library manager library; not physical robot library) is busy, then copy_ran_file will skip the transfer, since drives are not available. With this switch it will run encp anyway. A library is considered busy there is not at lease one idle drive. It is recommended to add admin priority for requests on this node. The exit status returned when -F is not used and the library is busy is zero.
- <count>: Number of tapes to check. Default is 1 if not specified. This value must be specified in order to specify the remaining arguments.
- <which_file>: Specifies any extra files to check on each tape beyond

the specified <count> value. Possible values are:

- onlyran: This is the default. Only choses or copies the randomly chosen file.
- onlyfirst: Ignore the chosen file and only use the first file on the chosen tape.
- onlylast :Ignore the chosen file and only use the last file on the chosen tape.
- alsofirst: In addition to the chosen file; the first file on the tape is also used.
- alsolast: In addition to the chosen file; the last file on the tape is also used.
- alsofirstlast: In addition to the chosen file; the first and last file on the tape is also used.

Runs on Host	As User	Runs at
Where integrity checks are run.	root	Every hour on the 27th minute.

5.8 delfile

This cronjob runs on the same node that the pnfs server runs on.

5.8.1 delfile.py

This cronjob updates the deleted status of a file in the Enstore file database. It works by looking through the files in the trash directory of pnfs for BFIDs, marking them deleted in the Enstore file database then deleting the trash file from the trash directory.

This cronjob should be run every five minutes. There will be a synchronization discrepancy between PNFS and Enstore until this cronjob runs after a file is deleted from PNFS.

Runs on Host	As User	Runs at
Where PNFS runs.	root	Every 5 minutes staring at the top of the hour.

5.9 drives_info

These cronjob(s) run on the web server node.

5.9.1 drives_info

Makes a web page reporting the serial numbers of the current set of tape

drives in use.

5.10 drivestat_db

These cronjobs run on the same machine as the PostgreSQL drivestat DB.

5.10.1 db_vacuum.py drivestat

Vacuums the drivestat DB to shrink the size on disk.

Runs on Host	As User	Runs at
Postgres DB	enstore	12:30am every day

5.11 enstore_db

These cronjobs run on the same machine as the PostgreSQL enstore DB.

5.11.1 db_vacuum.py enstoredb

Vacuums the enstore DB to shrink the size on disk.

Runs on Host	As User	Runs at
Postgres DB	enstore	2:30am every day

5.11.2 enstore backup

Backups the Enstore database to the backup node as defined in the configuration.

Runs on Host	As User	Runs at
Postgres DB	enstore	Every 10 minutes staring at the top of the hour.

5.12 enstore_html

These cronjob(s) run on the web server node.

5.12.1 enstore_system_html.py

5.12.2 make_quota_plot_page

5.12.3 make_cron_plot_page

5.12.4 make_ingest_rates_html_page.py

5.12.5 enstore system

5.12.6 enstore network

5.12.7 get_total_bytes_counter.py

5.13 enstore_plots

5.13.1 plotter.py --encp

5.13.2 plotter.py --mount

5.13.3 plotter_main.py [-m | --mount]

This cronjob script makes the plots showing the number of mounts for each media type per day.

Runs on Host	As User	Runs at
Where the web server runs.	enstore	Every day at 1:30am, 6:30am and 3:30pm.

5.13.4 plotter_main.py [-r | --rate]

This cronjob script plots the instantaneous network rates of all reads and writes.

Runs on Host	As User	Runs at
Where the web server runs.	enstore	Every hour on the 3rd and 33rd minute.

5.13.5 plotter_main.py [-u | --utilization]

This cronjob script makes the plots of the number of busy drives per media type.

Runs on Host	As User	Runs at
Where the web server runs.	enstore	Every hour on the 3rd and 33rd minute.

5.13.6 plotter_main.py [-s | --slots]

This cronjob script plots the number of free, used and disabled tape slots. For ADIC AML/2 robots this is by tower, for STK Powderhorn Silos it is by silo and for STK Streamline 8500s this is by rail.

Runs on Host	As User	Runs at
Where the web server runs.	enstore	Every hour on 10th minute.

5.13.7 make_sg_plot

5.13.8 plotter_main.py [-e | --encp-rate-multi]

This cronjob script plots each of the 5 encp rates recorded; once for read and once for writes per storage group.

Runs on Host	As User	Runs at
Where the web server runs.	enstore	Every hour on 25th minute.

5.13.9 plotter_main.py [-f | --file-family-analysis.py]

Report on the fill percentage of tapes per storage group.

Runs on Host	As User	Runs at
Where the web server runs.	enstore	Every day at 11:50pm.

5.13.10 plotter_main.py [-q | --quotas]

Plot the nuber of blank tapes available before running out or reaching the quota.

Runs on Host	As User	Runs at
Where the web server	enstore	Every 5 minutes staring

runs.		at the top of the hour.

5.13.11 plotter_main.py [-p | --pnfs-backup]

Plots the time required to backup the PNFS databases.

Runs on Host	As User	Runs at
Where the web server runs.	enstore	Every day at 1:15am and 1:15pm.

5.13.12 plotter.py --total_bytes --pts_nodes=d0ensrv2,stkensrv2,cdfensrv2 –no-plot-html

5.13.13 plotter_main.py [-i | --migration-summary]

Makes plots showing how many volumes for each media type have been migrated and/or duplicated.

Runs on Host	As User	Runs at
Where the web server runs.	enstore	Every hour at the bottom of the hour.

5.13.14 weekly_summary_report.py

5.13.15 plotter_main.py [-t | --tapes-burn-rate]

Plots the number of gigabytes used in the last 4 months by library and also library and storage_group pairs. Include information about how many blank tapes are remaining, and how many tapes were used in the last week and month.

Runs on Host	As User	Runs at
Where the web server runs.	enstore	Every hour at the top of the hour.

5.14 inventory

5.14.1 inventory.py

Makes the web pages listing all volumes and the files on each volume. Make

some of the inventory summary pages as well.

Runs on Host	As User	Runs at
Where the backups go.	enstore	Every hour on 50th minute.

5.15 inventory_web

These cronjob(s) run on the web server node.

5.15.1 cleaning_report

The CLEANING inventory page is generated.

Runs on Host	As User	Runs at
Where the web server runs.	enstore	Every day at 12:30am.

5.15.2 noaccess-tapes

The NOACCESS and VOLUMES inventory pages are generated.

Runs on Host	As User	Runs at
Where the web server runs.	enstore	Every 15 minutes staring at the top of the hour.

5.15.3 Vols

The files known to the robots are reported in *-VOLUMES.html. The asterisk is represents the short name of each media changer converted to uppercase.

Runs on Host	As User	Runs at
Where the web server runs.	enstore	Every day at 1:30am.

5.15.4 quota_alert

Makes the QUOTA_ALERT web page. Lists statistics reflecting the projected number of days each media_type, library and storage_group triplet will last with the current quota.

Runs on Host	As User	Runs at
Where the web server runs.	enstore	Every day at 8:30am and 4:30pm.

5.16 log_html

These cronjob(s) run on the web server node.

5.16.1 getnodeinfo

The nodeinfo.html file is created. This report lists all nodes in the enstore farmlet the kernel version, CPU speed, memory and other OS related value on one page.

Runs on Host	As User	Runs at
Where the log server runs.	root	Every hour at the 11th and 41st minute.

5.16.2 log_trans_fail

The failed transfer report is generated. This script greps through the recent log files and sorts the errors by volume and mover. This information can be useful when investigating any possible patterns involving a specific tape or drive.

Runs on Host	As User	Runs at
Where the log server runs.	enstore	Every hour on the 45th minute.

5.16.3 STKlog

Retrieves the last 1000 lines from the each acls_host found in every configured STK media changer. Names the output file *-log.html where * represents the short name of the configured media changer.

Runs on Host	As User	Runs at
Where the log server runs.	enstore	Every hour on the 2nd, 17th, 32nd and 47th minutes.

5.17 log_server

These cronjob(s) run on the log_server node.

5.17.1 log-stash

Zips and moves old logs files to the history directories.

Runs on Host	As User	Runs at

Where the log server runs.	enstore	On the 15th day of the month at 4:30am.

5.17.2 check_for_traceback

This script greps the log files for any Tracebacks. Any tracebacks are e-mailed to the addresses listed in the crons | developer_email section of the configuration.

Runs on Host	As User	Runs at
Where the log server runs.	enstore	Every hour on the 1st minute.

5.17.3 rdist-log

Copies the recent log files (that are not already copied) to the backup node for safe keeping. After log-stash moves the old log files, the matching old log files on the backup node are removed.

Runs on Host	As User	Runs at
Where the log server runs.	enstore	Every hour on the 5th, 20th , 35th and 50th minutes.

5.18 pnfs_misc

These cronjobs run on the same node that the pnfs server runs on.

5.18.1 PnfsExports

This cronjob makes the /enstore/pnfsExports.html web page. It is typically linked from the Log Files web page. It lists the PNFS mount points that are allowed to mount pnfs.

Runs on Host	As User	Runs at
Where the PNFS server runs.	root	Every hour on the 12th minute.

5.18.2 pnfs_monitor

A report is made of files listed in all PNFS databases (except admin) that do not have complete Enstore meta data. Exceptions are given to files that are dCache volatile files, zero length dCache files and temporary NFS files beginning with .nfs.

Runs on Host	As User	Runs at
Where the PNFS server runs.	root	Every day at 5:12am.

Chapter 6: ecron

This section describes the ecron script. For Enstore it is run by crond. Then ecron in turn starts the intended script or program to be run as a cronjob. This allows ecron to decide if e-mail should be sent; as opposed to crond sending an e-mail for every invocation of a cronjob. Histogram information is also reported by ecron.

6.1 Switches

- -x: debugging; must be first switch if present
- -q: quite output; must follow -x, go before others
- -p <name>: use specified name; default is the name of the script.
- -setup <products>: setup specified ups product before running cronjob
- -need-enstore: Verify that Enstore is running by asking the inquisitor; Default. -no-enstore skips this verification.
- -D <key>=<value>: Specify environmental variable to pass to the Enstore crontab script to be executed.
- -d <directory>: Set the directory that will be CWD for the cronjob script.
- -c <count>: The number of failures that need to occur before e-mail is sent. Default is 1.
- -l: Enable logging; this is default. -no-log disables logging; use for debugging only. Logging refers to ~/CRON/* files and accounting DB update.

6.2 Files

The files are located in the home area of the user executing them. Typically, the users should only be enstore or root.

16. ~/CRON/<cronjob_name>:
17. ~/CRON/<cronjob_name>HISTORGRAM: Contains all the starts and exit status of the cronjob. <cronjob_name> is the name of the script or the value specified with -p. These values are duplicated in the accounting DB.
18. ~/CRON/<cronjob_name>ACTIVE: If present, this script is currently running. This is a lock file.
19. ~/CRON/<cronjob_name>-output: The stdout and stderr contents from the last time the cronjob was run.
20. ~/CRON/<cronjob_name>-output.<timestamp>: The last 5 error runs are kept.

6.3 Samples

Here are two sample command lines for various cronjobs. They are color coded to match the descriptions below.

9. 27 * * * * root source /usr/local/etc/setups.sh; setup enstore; $ENSTORE_DIR/sbin/ecron -p copy_ran_file $ENSTORE_DIR/sbin/copy_ran_file 1 alsofirstlast > /dev/null 2> /dev/null
10. 5,20,35,50 * * * * enstore source /usr/local/etc/setups.sh; setup enstore; $ENSTORE_DIR/sbin/ecron -p rdist-log rdist-log > /dev/null 2> /dev/null

The follow are the descriptions of the different parts of the crontab file line when using ecron.

15. Time when crond should start the scripts.
16. User to run the cronjob as.
17. Command line invocated by crond.
18. Ecron command line options.
19. Script to be run by ecron.
20. Arguements passed to the script run by ecron.
21. Redirect the output from ecron to /dev/null. ecron decides to send e-mail or not. crond will always send e-mail if the output is not redirected.

6.4 Troubleshooting

Problems	Solutions
Cronjob is active for to long and is verified to still be running.	Determine what is the problem. Likely causes are bad disk, networking or a server is down.
Cronjob is active for to long and is verified to not be running.	Remove the ~/CRON/<cronjob_name>ACTIVE file.
Cronjob is failing consistently.	Check the output in the e-mail or ~/CRON/<cronjob_name>-output file.
ecron has determined Enstore to be down.	Verify if Enstore is down or not. If Enstore is up, check if the inquisitor is responding to commands; nothing to do if inquisitor is not responding.
Cronjob is not getting started.	Check if the line in the crontab file is commented out.

Chapter 7: PNFS Maintenance

This chapter documents various PNFS related operations that need to be done from time to time.

7.1 Adding a new PNFS Database

When a new experiment requests access to Enstore they will need to have their own PNFS database assigned. Names for their database and database mount point need to be chosen; it is recommended that the same name be used for both, but this is not a requirement.

Key information that will be needed before starting this task:

- Will this database be a new top level PNFS database area or reside underneath an already existing PNFS database area.
- The name of the PNFS database that will be created.
- The name of the directory that users will see as the top of the new PNFS database. For simplicity, it is recommended that this be the same as #1 above.
- The user id (UID) and group id (GID) of the group of users the new PNFS area will be assigned to.
- The name of the storage group that this database will be associated with. This should match the name in #1 and #2 above, but is not a hard requirement.
- The name of the file family that the files will be written with. For a new top level database this can be set to the same value as the storage group. If not, then there is generally a reason that the owner(s) wants to segregate there data; which likely means this should be set to something unique.

These instructions assume that mdb is located in /opt/pnfs/tools; substitute accordingly for your installation. Lets assume that the database name will be called edata. The following commands are all run on the node running the PNFS server.

- `# source /usr/etc/pnfsSetup`
- *For PNFS servers using GDBM only (**PostgreSQL backed PNFS servers do not do this step**); stop the PNFS daemons.*
  `# $pnfs/tools/pnfs.server stop`
- *Create the new database.*
  `# $pnfs/tools/mdb create edata $database/edata`
- *Start the new dbserver for the new database.*
  1. *For **PostgreSQL** backed PNFS databases to start the newly*

created PNFS dbserver:

```
# $pnfs/tools/mdb update
```

2. *For **GDBM** backed PNFS databases to restart PNFS.*

```
# $pnfs/tools/pnfs.server start
```

- *Find the database number for the edata database.*

```
# $pnfs/tools/mdb show
 ID   Name         Type    Status       Path
 ------------------------------------------
 0    admin         r     enabled (r)   /srv/pnfs/db/admin
 1    mist          r     enabled (r)   /srv/pnfs/db/mist
 3    mist2         r     enabled (r)   /srv/pnfs/db/mist2
 4    flake         r     enabled (r)   /srv/pnfs/db/flake
 5    Migration     r     enabled (r)   /srv/pnfs/db/Migration
 6    edata         r     enabled (r)   /srv/pnfs/db/edata
```

- *From the mdb show command, we can see that edata was assigned database number 6. We need to create a starting point to this database. The key command in the example(s) below is the mkdir. The 6 (or 7) in the examples would be the assigned database number mdb assigned. And the edata (or edata2) here refers to the name of the directory users will see. The directory created will not be named '.(#)(name)', but this is how this special information is passed to PNFS using the NFSv2 protocol.*

  1. *If the database is intended to be a **top level** database in PNFS.*

```
# cd /pnfs/fs/usr/
# mkdir '.(6)(edata)'
# chmod 777 edata
```

  2. If the *database is destined for use **underneath an already existing PNFS database** area then the cd would have been done to another directory followed by the mkdir and the chmod. The following example shows how this would be done to add an edata2 PNFS database area underneath an already existing edata PNFS database area.*

```
# cd /pnfs/fs/usr/edata
# mkdir '.(7)(edata2)
# chmod 777 edata2
```

The rest of this example will go back to explaining how to create the top level edata PNFS database area.

- *We need to create the PNFS tags in this directory. The value for the library should match that of a library in the current configuration. In most cases the storage_group should be set to match that of the newly created database name, edata, in this example.*[4]

```
# cd edata
# enstore pnfs --library LTO4
# enstore pnfs --file-family edata
# enstore pnfs --file-family-wrapper cpio_odc
```

4 For PNFS areas to be used for volatile or resilient dCache pool metadata, different tags are used. Consult dCache documentation for instructions.

```
# enstore pnfs --file-family-width 1
# enstore pnfs --storage_group edata
```

- *Set the group to own these tags. Also, set the permission. Tags file_family and file_family_width should be owned by the group with permissions 664. The other three should be owned by root with persmissions 644.*

```
# enstore pnfs --tagchmod 644 file_family
# enstore pnfs --tagchmod 644 file_family_width
# enstore pnfs --tagchown <owner>.<group>
file_family
# enstore pnfs --tagchown <owner>.<group>
file_family_width
```

- *They can be checked with:*

enstore pnfs --tags

```
.(tag)(library) = LTO4
.(tag)(storage_group) = edata
.(tag)(file_family) = edata
.(tag)(file_family_width) = 1
.(tag)(file_family_wrapper) = cpio_odc
-rw-rw-r--  1 root root 4 Oct 31  2001 /pnfs/fs/usr/edata/.(tag)
(library)
-rw-rw-r--  1 root root 3 Oct 31  2001 /pnfs/fs/usr/edata/.(tag)
(storage_group)
-rw-rw-r--  1 edata edata 3 Jan 23  2003 /pnfs/fs/usr/edata/.(tag)
(file_family)
-rw-rw-r--  1 edata edata 1 Mar  1  2006 /pnfs/fs/usr/edata/.(tag)
(file_family_width)
-rw-rw-r--  1 root root 4 Oct 31  2001 /pnfs/fs/usr/edata/.(tag)
(file_family_wrapper)
```

At this point, if the database is being added as a sub directory underneath an already existing PNFS database area everything is done. If the PNFS database is a new top level PNFS database for a new group using Enstore keep following steps 9 through 13.

- *The next step is to enable wormhole access. The conventional value for $shmkey is 1122. The 6 is the database number from the mdb show command.*

```
# pnfsCID=`cat "/pnfs/fs/admin/etc/.(id)(config)"`
# pnfs/tools/sclient getroot $shmkey 6 $pnfsCID
```

- *Next enable the Enstore servers to mount PNFS. Substitute "ensrv1" in the example with the names of the Enstore server nodes. Do the same for any user's nodes that need to mount PNFS. Be sure to verify that the user's nodes have static IP addresses. If they have dynamic address send email stating why this can not be completed.*

```
# $pnfs/tools/pmount add ensrv1 /edata
```

- *Now create the mount directory on each Enstore server. Substitute the correct rgang farmlet for ensrv in the following example.*

```
# rgang ensrv 'mkdir /pnfs/edata'
```

- *Next modify the /etc/fstab file for each Enstore server to contain the*

line:

```
www-ensrv1:/edata   /pnfs/edata   nfs
sync,rsize=4096,wsize=4096,user,intr,bg,hard,rw,noac   0   0
```

The example is really one long line, but is broken into two for readability. If the contents of /etc/fstab are governed by a configuration management tool (like cfengine) then follow the procedure to update the system configuration. Otherwise, an rgang command similar to that in the preceding step will suffice.

- Mount the new PNFS area on at least the PNFS node and the node configured to run the copy_ran_file cronjob.
  # mount /pnfs/edata
- Send an e-mail to the new group with the `/etc/fstab` line they will need to add to their node's `/etc/fstab` file.

7.2 Giving Systems Access to PNFS

7.2.1 Using pmount (1st method)

First look to determine if the hostname or the IP address is already assigned. If it is then corrective actions will need to take place.

```
# $PNFS_DIR/tools/pmount show hosts | egrep "<hostname>[|<IP address>]"
```

Second, the mount point needs to be obtained. In the following output, the mount point is from the first column: /admin, /mist, etc.

```
# $PNFS_DIR/tools/pmount show host <hostname>
```

```
 ----------<hostname> ------------------
 /admin      0 /0/root/fs/admin/etc
 /mist      30 /0/root/fs/usr/mist
 /mist-volmap 30 /0/root/fs/usr/mist-volmap
 /fs         0 /0/root/fs
 /flake     30 /0/root/fs/usr/flake
```

Next, the new hostname will be assigned. The <hostname> value is the hostname without any domain name included. The mount point

```
$ pmount add <hostname> <mountpoint>
```

7.2.2 Using UNIX tools (2nd method)

We assume that `/pnfs/fs` is mounted on the PNFS node for these steps. These commands should be run on the PNFS server node.

First look to determine if the hostname or the IP address is already assigned. If it is then corrective actions will need to take place.

```
# cd /pnfs/fs/admin/etc/exports
```

```
# ls -l | egrep "<hostname>[|<IP address>]"
```

Copy an existing file in this directory to a temporary file on local disk. It is recommended that it already have the mount point you are giving access to. Modify the now local copy of the file to just contain the mount points that the new node will be allowed to mount. When done just copy the temporary file to the filename of the IP address of the node gaining access to this PNFS mount point. In the example, the 131.225.333.444 exports file is used to create the exports file for 131.225.333.555.

 You can not use **vi** on files in this PNFS directory . Its use of temporary files results in the file being corrupted.

```
# cp 131.225.333.444 /tmp/131.225.333.555

# vi /tmp/131.225.333.555

# cp /tmp/131.225.333.555 131.225.333.555
```

Now create the hostname symbolic link to the new file. The hostname must not contain the domain name.

```
# ln -s 131.225.333.555 <hostname>
```

7.2.3 Trusted PNFS Nodes

Trusted PNFS nodes are allowed to have user root manipulate all filesystem related metadata in `/pnfs/fs/usr/` style paths. All requests for trusted access should be confirmed before granting.

To Configure a machine to be trusted, an access file with the same name as the mounting nodes IP address needs to be created in the trusted directory.

```
# cd /pnfs/fs/admin/etc/exports/trusted

# echo 15 > 131.225.222.333
```

7.3 Removing Invalid Directory Entries

These files are those with a directory entry that points to an invalid/nonexistent inode. They can be found by doing (in bash):

22. An **ls** of the specific file and getting "No such file or directory".
23. An "**ls | grep** <basename>" and getting a file listing.

Reminder: You need to log onto the pnfs server, use the /pnfs/fs path and be user root for these commands to work.

Notes: Taking the file /pnfs/fs/usr/mydir/myfile; <basename> refers to myfile in the following examples and <directory> refers to /pnfs/fs/usr/mydir.

On occasion the NFS client will continue to cache that a file was there after it has been successfully removed from the database. Waiting a while for the cache to clear out is the simplest option. For the impatient you can force an unmount ("umount -f -l ..." on linux; the second switch is ell not one) and then remount the file to clear up the problem.

7.3.1 To remove them (1st method):

If pnfs was installed using UPS

```
# setup pnfs
```

or if installed from RPM

```
# source /usr/etc/pnfsSetup

# cd <directory>
# $pnfs/tools/scandir.sh | grep <basname>
```

Paste the results from scandir.sh as arguments to Sclient.

```
# Sclient <line from scandir.sh output>
```

Answer yes to **Sclient** to execute the listed `sclient rmdirentrypos` command.

7.3.2 To remove them (2nd method):

If pnfs was installed using UPS

```
# setup pnfs
```

or if installed from RPM

```
# source /usr/etc/pnfsSetup

# cd <directory>
# $pnfs/tools/scandir.sh | grep <basname>
```

First output from scandir is the directory id, followed by the file id, then other output then the position.

```
# $pnfs/tools/sclient rmdirentrypos $shmkey \
<dirID>  <rmID> <position>
```

7.3.3 To remove them (3rd method):

Sometimes the positional way(s) does not work. Try this next where <basename> is the name of the 'broken' file.

If pnfs was installed using UPS

```
# setup pnfs
```

or if installed from RPM

```
# source /usr/etc/pnfsSetup

# cd <directory>
# $pnfs/tools/sclient rmdirentry $shmkey <dirID> \
<basename>
```

7.4 Restoring Tag Inheritance

By default a directory's tags point to the same tag in its parent directory. If directories are moved around and removed; it is entirely possible that a directory's tags point to the tags of a nonexistent directory. To fix this requires finding out the PNFSID of the matching current parent directory's tag. First a short example of how this can happen.

```
$ cd /pnfs/test/
$ mkdir xyz          #make the first directory
$ cd xyz
$ mkdir abc          #make the second under the first
$ mv abc ..          #move the second up a level
$ cd ..
$ rmdir xyz          #remove the first directory
$ cd abc
$ enstore pnfs --tags
.(tag)(library) : [Errno 2] No such file or directory: '/pnfs/test/abc/.(tag)
(library)'
.(tag)(storage_group) : [Errno 2] No such file or directory: '/pnfs/test/abc/.
(tag)(storage_group)'
.(tag)(file_family) : [Errno 2] No such file or directory: '/pnfs/test/abc/.
(tag)(file_family)'
.(tag)(file_family_width) : [Errno 2] No such file or directory:
'/pnfs/test/abc/.(tag)(file_family_width)'
.(tag)(file_family_wrapper) : [Errno 2] No such file or directory:
'/pnfs/test/abc/.(tag)(file_family_wrapper)'
ls: /pnfs/test/abc/.(tag)(library): No such file or directory
ls: /pnfs/test/abc/.(tag)(storage_group): No such file or directory
ls: /pnfs/test/abc/.(tag)(file_family): No such file or directory
ls: /pnfs/test/abc/.(tag)(file_family_width): No such file or directory
ls: /pnfs/test/abc/.(tag)(file_family_wrapper): No such file or directory
```

To restore the storage group tag inheritance we need to first find the PNFS ID of the /pnfs/test storage_group tag. To do this we need to obtain the PNFS ID

of the current parent directory[5] then find its pointer to the PNFS ID of the first tag.

```
$ enstore pnfs --id /pnfs/fs/usr/test
000100000000000000001060
$ enstore pnfs --showid 000100000000000000001060
------------------------------------------------------
ID            : 000100000000000000001060
Type          : --I--d-----
next ID       : 000000000000000000000000
base ID       : 000000000000000000000000
parent ID     : 000000000000000000001080
creation time : Wed Oct 31 14:54:05 2001
modif. time   : Wed Mar 26 09:56:05 2008
Type          : Directory ( Inode )
mst_dev        : 1
mst_ino        : 16781408
mst_mode       : 40755
mst_nlink      : 1
mst_uid        : 9276
mst_gid        : 1530
mst_rdev       : 100
mst_size       : 512
mst_atime      : Wed Mar 26 09:56:05 2008
mst_mtime      : Wed Mar 26 09:56:05 2008
mst_ctime      : Wed Oct 31 14:54:05 2001
mst_blksize    : 512
mst_blocks     : 1
Tag               : 000100000000000000001080      The first tag pnfsid.
Group             : 0
Entries           : 31
Hash Function     : 0
Hash Size         : 128
Hash EntriesPerRow : 77
Hash Rows         : 2
000100000000000000001068 000100000000000000001070
```

Next we need to look at the contents of this first tag PNFS ID. The “next ID” field contains the PNFS ID of the next tag in the list of tags for the directory. “base ID” gives the PNFS ID of the directory that this tag belongs to. The “Name” field gives the name of the Tag. Some output clipped for compactness.

```
$ enstore pnfs --showid 000100000000000000001080
------------------------------------------------------
ID            : 000100000000000000001080
Type          : --I------t-
next ID       : 000100000000000000001088
base ID       : 000100000000000000001060
parent ID     : 000000000000000000000000
...
Type          : Tag ( Inode )
Name     : library
...
```

The first tag in the list is the library tag. We are looking for the storage group tag, so we need to take the “next ID” value and do the **enstore pnfs --showid** command again.

5 Any directory's tags could be used, but using the current parent directory makes the most sense.

```
$ enstore pnfs --showid 000100000000000000001088
 ------------------------------------------------
 ID           : 000100000000000000001088
 Type         : --I------t-
 next ID      : 000100000000000000001090
 base ID      : 000100000000000000001060
 parent ID    : 000000000000000000000000
...
 Type         : Tag ( Inode )
 Name     : storage_group
...
```

Next repeat this steps to find the PNFS ID of the broken tag looking through the showid output from the broken directory and the “next ID” fields in the tags list until the correct one (storage_group for this example) is found.

```
$ enstore pnfs --id /pnfs/test/abc
000100000000000000852C0
$ enstore pnfs --showid 000100000000000000852C0
...
 Tag              : 000100000000000000852D8
...
$ enstore pnfs --showid 000100000000000000852D8
...
 next ID      : 000100000000000000852E0
...
 Name     : library
$ enstore pnfs --showid 000100000000000000852E0
...
 Name     : storage_group
...
```

Now the storage group tag has been found. We need to take these PNFS IDs and pass it to **sclient** to fix the tags. Running sclient without any options prints the help message.

```
# /opt/pnfs/tools/sclient
...
 USAGE : /fnal/ups/prd/pnfs/v3_1_10-f2/tools/sclient chparent <shmkey>
<objectId> <parentId>
...
```

Now we can run this command. The <shmkey> should be 1122; look in the /usr/etc/pnfsSetup file for the shmkey line to be sure. Then we just need to pass the PNFS ID of the broken tag we want to fix followed by the tag we want it to inherit from.

```
# cd /pnfs/fs/usr/test/abc
#/opt/pnfs/tools/sclient chparent 1122 \
000100000000000000852E0 000100000000000000001088
```

We can see the effect with the **enstore pnfs --tags** command.

```
# enstore pnfs --tags
```

```
.(tag)(library) : [Errno 2] No such file or directory:
'/pnfs/fs/usr/test/abc/.(tag)(library)'
.(tag)(storage_group) = zee
.(tag)(file_family) : [Errno 2] No such file or directory:
'/pnfs/fs/usr/test/abc/.(tag)(file_family)'
.(tag)(file_family_width) : [Errno 2] No such file or directory:
'/pnfs/fs/usr/test/abc/.(tag)(file_family_width)'
.(tag)(file_family_wrapper) : [Errno 2] No such file or directory:
'/pnfs/fs/usr/test/abc/.(tag)(file_family_wrapper)'
ls: /pnfs/fs/usr/test/abc/.(tag)(library): No such file or directory
-rw-rw-r--  11 enstore enstore 3 Oct 31  2001
/pnfs/fs/usr/test/abc/.(tag)(storage_group)
ls: /pnfs/fs/usr/test/abc/.(tag)(file_family): No such file or directory
ls: /pnfs/fs/usr/test/abc/.(tag)(file_family_width): No such file or directory
ls: /pnfs/fs/usr/test/abc/.(tag)(file_family_wrapper): No such file or
directory
```

Repeat this procedure with the remaining broken tags.

7.5 Fixing Broken Tags

A tag becomes invalid when there is no 'local' tag value and the parent tag it references does not exist. Sometimes it is necessary to forcibly rewrite the local portion of the tag to clear the 'invalid' status. The “0 0 10” are 'magic values' from the PNFS developers[6] that are the level, offset and size, respectively.

```
# source /usr/ec/pnfsSetup
# $pnfs/tools/sclient writedata $shmkey \
  <tag pnfs id> 0 0 10
```

6 Patrick Fuhrmann

Chapter 8: Configuration File

8.1 Configuration Descripton

The Enstore configuration file is a native python file. This allows for a lot of flexability in setting up the configuration.

8.2 Useful Shortcuts and Variables

8.3 Non-server Entries

8.3.1 blocksizes

This section defines the block sizes used when reading and writing different media types. The media types listed are the valid types available for the **`enstore volume –add`** command in section 1.24.

```
configdict['blocksizes'] = { '8MM'       : 131072,
                             'DECDLT'    : 131072,
                             '9840'      : 131072,
                             '9940'      : 131072,
                             '9940B'     : 131072,
                             '3480'      : 131072,
                             'LTO'       : 131072,
                             'LTO2'      : 131072,
                             'LTO3'      : 131072,
                             'LTO4'      : 131072,
                             'null'      : 131072,
                             'diskfile'  : 512,
                             }
```

8.3.2 crons

These values are used by the cronjob scripts to know the locations of various files or directories, hostnames and e-mail addresses. Every site needs to define there own values for html_dir, log_dir, backup_dir and monitoring and web.

```
configdict['crons'] = {
   #'www_alias'       : www_alias, #optional
   #'conf_alias'      : conf_alias, #optional
   #'pnfs_alias'      : pnfs_alias, #optional
   'web_node'         : monitoring_and_web,
   'html_dir'         : html_dir,
   'log_dir'          : log_dir,
   'tmp_dir'          : "/tmp",
   'email'            : "enstore-auto@fnal.gov",
   'developer_email' : “enstore-devel@fnal.gov"
   'backup_node'      : enstore_backup,
   'backup_dir'       : backup_dir,
   'monitored_nodes' : [
                       "ensrv0",
                       "ensrv1",
                       "ensrv2",
                       "ensrv3",
                       "ensrv4",
                       "ensrv5",
                       ],
   'farmlets_dir'     : "/usr/local/etc/farmlets",
   'url_dir'          : "http://www-en.fnal.gov/enstore/",
   #'test_library_list' : [“test-9940B”],
   }
```

- www_alias, conf_alias and pnfs_alias are optional DNS names to identify the web server host, configuration server host and PNFS server host. These are not required for Enstore to work, however they can be used to more easily move services from one node to another.
- web_node is the host name of the web server.
- html_dir is the directory that the inquisitor, alarm server, monitor server and many cronjobs write html, jpg, gif and other web content too.
- log_dir is the directory that the log server writes the log files into.
- tmp_dir can be used to use a different temporary directory for some cronjobs.
- email specifies the comma separated email addresses operational important errors should be sent to.
- developer_email will at most sites be the same as email.
- backup_node defines the host that the Enstore DB and PNFS DB backups are copied to.
- backup_dir is the directory on the backup_node that the Enstore DB and PNFS DB backups are copied to.
- monitored_nodes specifies the list of host names to limit the

generation of cron job status plots. In all likelihood this should contain the current names of all the Enstore server host names; not the mover host names.

- farmlets_dir specifies the location of the farmlets files.
- url_dir indicates the base URL value for the Enstore systems web area. It is used by some cron jobs that create pages in sub directories to point to images or other web pages in this top level URL directory or predetermined sub directories.
- enstore_name should contain a unique string that defines what this instance is used for. Likely considerations include naming production and test stands differently. For sites with multiple production Enstore systems, this allows them to be given human differentiable names.
- test_library_list is used by **choose_ran_file** and **copy_ran_file** to exclude the supplied list of libraries.

8.3.3 crontabs

This section defines which nodes should run which cronjobs. If the primary key matches the name of an Enstore server then those crontab files are copied to /etc/cron.d by install_crons.py. Primary keys examples are `log_server` and `accounting_server`. The files that install_crons.py copies to /etc/cron.d are listed in each `cronfiles` subsection. For the log_server, there are `log_server` and `log_html`. If the primary key is not an Enstore server, `verifying` and `pnfs`, are two such examples, then a host subfield is required.

```
configdict['crontabs'] = {
   'log_server'       : {'cronfiles' : ["log_server",
                                       "log_html",
                                       ]},
   'web_server'       : {'cronfiles' : ["enstore_plots",
                                       "enstore_html",
                                       "inventory",
                                       "chkcrons",
                                       #"tab_flipping",
                                       ],
                         'host'      : monitoring_and_web},
   'verifying'        : {'cronfiles' : ["checkPNFS",
                                       "copy_ran_file",
                                       ],
                         'host'      : verify_host},
   'pnfs'             : {'cronfiles' : ["delfile",
                                       "pnfs_misc",
                                       ],
                         'host'      : enstore_pnfs},
   'accounting_server' : {'cronfiles' : ["accounting_db"]},
   'drivestat_server'  : {'cronfiles' : ["drivestat_db"]},
   'file_clerk'       : {'cronfiles' : ["enstore_db"]},
   'databases'        : {'cronfiles' : ["backup",
                                       #"backup.operation",
                                       #"backup2Tape",
                                       ],
                         'host'      : enstore_backup},
   }
```

8.3.4 database

The volume clerk, file clerk and info_server share a single PostGreSQL database. The shared information for these servers to locate the database is placed here.

```
configdict['database']    = {
   'dbname': 'enstoredb',
   'dbhost': DB_host,
   'dbport': 8888,
   'dbuser': 'enstore',
   'dbserverowner': 'products',
   'dbarea':'%s/enstore-db' % (db_basedir,),
   }
```

8.3.5 discipline

For limiting the number of simultaneous transfers for a node. Nodes containing the string saen will be limited to 2 simultaneous transfers for the null library for the storage groups null_group1 and null_group2.

```
configdict['discipline'] = {
   'null.library_manager':{'null_group1':{1:{'keys':{'host':"saen"},
                                             'function':'restrict_host_access',
                                             'args':['null_group1','saen',2],
                                             'action':'ignore'},
                                            },
                           'null_group2':{1:{'keys':{'host':"saen"},
                                             'function':'restrict_host_access',
                                             'args':['null_group2','saen',2],
                                             'action':'ignore'},
                                            },
                           },
   }
```

8.3.6 encp

The CRC seed for new sites should set this to 1. For older sites, consult knowledgeable experts. If the this value is missing from the configuration file then the crc_seed will default to 1.

```
configdict['encp'] = {'crc_seed' : crc_seed,
                      }
```

8.3.7 inventory

```
configdict['inventory'] = {
   'inventory_dir'             : inventory_dir,
   'inventory_tmp_dir'         : "%s/tmp" % (inventory_dir,),
   'inventory_cache_dir'       : "%s_cache" % (inventory_dir,),
   'inventory_extract_dir'     : "%s/extract" % (inventory_dir,),
   'inventory_rcp_dir'         : '%s:%s/tape_inventory' % (monitoring_and_web,
html_dir,),
   'wpa_states'                : ["full", "readonly"],
   'wpa_excluded_libraries'    : ["samnull", "testlto", "testlto2", "TEST-9940B
", "D0-LTO4G1T"],
   }
```

21. inventory_dir:
22. inventory_tmp_dir:
23. inventory_cache_dir: Directory where a local on-disk copy of the inventory is kept to skip processing volume metadata that has not been modified since the previous time the inventory cronjob was run.
24. inventory_rcp_dir: Remote host and directory to copy the output files to once they are done being generated.
25. wpa_states:
26. wpa_excluded_libraries:

8.3.8 priority

The most common use of the priority section is to bestow admin_priority to encp transfers. In the following example the **null** library manager will assign **adminpri** priority to encp transfers running from the **verify_host** as user **enstore**.

```
configdict['priority'] = {
   'null.library_manager':{'adminpri':{2:
                                {'host': verify_host,
                                 'uname':'enstore',
                                 #'storage_group':'null_group1',
                                 #'work' : 'write_to_hsm',
                                 #'work' : 'read_from_hsm',
                                 },
                                },
                    },
   }
```

11. host: if defined limits the admin priority to encp transfers from this host.
12. uname: The user name of the owner of the encp transfer.
13. storage_group: Limit these privileges to certain experiments or groups.
14. work: may be **write_to_hsm** or **read_from_hsm**. These limit the priority setting to just writes or reads, respectively.

8.3.9 wrappersizes

There are only three defined file wrappers for Enstore. These wrappers are used to “wrap” metadata onto the media with the data file. These values are what needs to be inserted into the PNFS file_family_wrapper tag, see section ???????????.

```
configdict['wrappersizes'] = { 'null' : (100L*GB) - 1,
                               'cern' : long("9"*20),
                               'cpio_odc' : (8L*GB) - 1,
                               }
```

8.3.10 web_server

These are the values used by the post installation steps of the enstore_html.rpm.

```
configdict['web_server'] = {
   'ServerHost'     : web_server_host,
   'User'           : 'enstore',
   'Group'          : 'enstore',
   'port'           : 80,
```

```
    'ServerName'     : '%s.fnal.gov' % (www_alias,),
    'DocumentRoot'   : "%s/html" % (httpd_dir2,),
    'ScoreBoardFile' : "%s/apache_status" % (httpd_dir,),
    'PidFile'        : "%s/adm/httpd.pid" % (httpd_dir,),
    'ErrorLog'       : "%s/adm/error.log" % (httpd_dir,),
    'CustomLog'      : {
       'combined' : "%s/adm/access.log" % (httpd_dir,),
       'referer'  : "%s/adm/referer.log" % (httpd_dir,),
       'agent'    : "%s/adm/agent.log" % (httpd_dir,),
       },
    'ServerRoot'  : '/etc/httpd/' ,
    'ScriptAlias' : {
       'fake' : '/cgi-bin/',
       'real' : "%s/cgi-bin/" % (httpd_dir2,),
    }
}
```

8.4 Server Entries

Common Entries: The host, port andlogname fields are mandatory. The rest are optional.

24. host – The hostname of the machine the Enstore server will run on.
25. hostip – Performs the same function of host. The additional functionality is to specify a single IP address for Enstore use on multi-homed machines.
26. port – The port number the Enstore server should listen on.
27. logname – The name of the server that appears in the logfile. Should be between 2 and 8 characters; but this is not a hard limit.
28. inq_ignore – If this is defined, then the inquisitor will not monitor the server. This is recommended for test library manager, test media changes and test movers.
29. norestart – This configuration item lets the inquisitor to know not to restart the server if it is found to be down.
30. noupdown – The “enstore system” process will not look at the corresponding server when generating the Status At-A-Glance web page.

8.4.1 alarm_server

The only unique configuration information for the alarm server is alarm_actions. The only currently defined actions are for sending some e-mailable alarms straight to users instead of putting it on the alarms page. If

the storage group is not found here then the default is to place the alarm on the alarms web page.

```
configdict['alarm_server'] = {
   'host':alarm_server_host,
   'port':7503,
   'logname':'ALMSRV',
   'norestart':'INQ',
   'alarm_actions' : {'C' : [['send_mail', '*',
                             {
                              'sdss' : 'sdssdp@fnal.gov',
                              }
                             ],
                             ['send_mail', '1',
                              {'cms' : 'cms-t1@fnal.gov',
                              }
                             ],
                            ]}
   }
```

- alarm_actions: The alarm type value, C in the preceding example, must be one of the following list:
  - A for a regular alarm
  - E for an error alarm.
  - U for a User error/alarm.
  - W for a Warning alarm.
  - I for Information only alarm.
  - C for an E-mailable alarm.

  There is little functional difference among these types of alarms. What is different is the single letter log message designation when the alarm is logged with the log server.
  When an alarm type of C is received by the alarm server it looks though list of possible actions. Currently only send_mail is defined. It has limit value. Either ***** or **1** for send an e-mail for every occurrence of the same alarm or only send it once via e-mail then put it on the alarms page for every occurrence after that, respectively. The third element in these lists is a dictionary paring the storage group to an e-mail address or a list of comma separated e-mail addresses.

8.4.2 event_relay

The event_relay does not contain any non-common server configuration items.

8.4.3 log_server

```
configdict['log_server'] = {
   'host':log_server_host,
   'port':7504,
   'norestart':'INQ',
   'msg_type_logs': {'MSG_TYPE=MC_LOAD_REQ'  : 'MOUNTS-',
                     'MSG_TYPE=MC_LOAD_DONE' : 'MOUNTS-',
                     'MSG_TYPE=ENCP_XFER'    : 'ENCPS-',
                     'MSG_TYPE=EVENT_RELAY'  : 'EVRLY-',
                     'MSG_TYPE=ADD_TO_LMQ'   : 'LMQADDS-'},
   'log_file_path':log_dir,
   }
```

- log_file_path refers to the directory that the log files are to be written into. In the example, the log_dir variable is used to hold the actual directory name.
- msg_type_logs

8.4.4 file_clerk

```
configdict['file_clerk'] = {
   'host':file_clerk_host,
   'port':7501,
   'logname':'FILSRV',
   'norestart':'INQ',
   'brand':'D0MS',
}
```

- brand: Brand is an optional field. If set it names characters that appear at the be beginning of every bit file id (BFID). If this is not set, then a suitable brand string is determined based on the hostname. There is no limit on the length, though 4 alpha numeric characters is recommended. The last brand character must be alphabetical only. This field is used to differentiate different Enstore systems running at a single site; in which case it is **strongly** recommended to be used.

8.4.5 volume_clerk

```
configdict['volume_clerk'] = {
   'host':volume_clerk_host,
   'port':7502,
   'logname':'VOLSRV',
   'norestart':'INQ',
   'max_noaccess_cnt' : vol_max_noaccess_cnt,
}
```

- max_noaccess_cnt:

8.4.6 info_server

```
configdict['info_server'] = {
   'host': info_server_host,
   'port': 7777,
   'logname': 'INFSRV',
   'norestart':'INQ',
   }
```

8.4.7 pnfs_agent

Reserved for future use.

8.4.8 monitor_server

```
configdict['monitor_server'] = {
   'html_dir'          : html_dir,
   'html_gen_host'     : web_server_host,
   'refresh'           : 3600,
   'veto_nodes'        : {'watertaxi': 'not in system my reason'},
   'block_size'        : 65536,
   'block_count'       : 160,
   'default_timeout'   : 3,
   }
```

7. html_dir: Must point to the same location as the html_dir field in the `crons` section of the configuration file.
8. html_gen_host: This refers to the host running the monitor server that also is running the web server. It is important for the monitor server specified here to be running all the time.
9. refresh:
10. veto_nodes: This is a list of hosts to skip during the `enstore network` check. A reason for each host is also allowed.
11. block_size and block_count: These two values multiplied together represent the amount of data sent during each `enstore network` rate test performed. The values listed in the example are known to

work well for Fast Ethernet speeds.

12. default_timeout: Amount of time to wait for a response from a monitor server running on each node. After this timeout `enstore network` skips to the next node in the list.

8.4.9 ratekeeper

```
configdict['ratekeeper'] = {
    'host'              : ratekeeper_host,
    'port'              : 55511,
    'norestart'         : 'INQ',
    'noupdown'          : 'efb',
    'logname'           : 'RATSRV',
    'dir'               : ratekeeper_dir,
    'tmp'               : "%s/tmp/" % (ratekeeper_dir,),
    'ps'                : '%s/*rates.ps' % (html_dir,),
    'jpg'               : '%s/*rates.jpg' % (html_dir,),
    'stamp'             : '%s/*rates_stamp.jpg' % (html_dir,),
    }
```

2. dir: Deprecated field that names the directory where the ratekeeper rate files are written into. This information be default is automatically inserted into the accounting database. If this field is set then the rate information is written to the text files and the database.
3. tmp, ps, jpg and stamp: These are deprecated fields used by makeplot. The enstore plot command has superseded makeplot.

8.4.10 library_manager

```
configdict['9940B.library_manager'] ={
   'host':library_manager_host,
   'port':7522,
   'encp_port':7523
   'mover_port':7524
   'logname':'9940BLM',
   'norestart':'INQ',
#    'blank_error_increment':'5',
#    'max_encp_retries':3,
#    'max_suspect_movers':'3',
   'max_file_size':(200L*GB) - 1,
   'min_file_size':100*MB,
   'CleanTapeVolumeFamily': 'CLEAN.CleanFileFamily.noWrapper',
   'suspect_volume_expiration_time':3600*24,
   'legal_encp_version':legal_encp_version,
   'storage_group_limits':{'cms':10,
                           'cdf':10,
                           'D0':10,
                          },
   'max_requests':10000,
   'lock':"nowrite",
}
```

All the library manager specific configuration options are optional.

5. encp_port: An alternate port that only **encp** v3_8 and later uses for submitting file requests. This is an optional value and the default for encps is to use regular port number if this is not specified.
6. mover_port: An alternate port that only movers use for communicating with the library manager. This is an optional value and the default for movers is to use regular port number if this is not specified.
7. blank_error_increment: In case of FTT_EBLANK errors, do not set the volume NOACCESS until the error count is greater than (max_suspect_movers + blank_error_increment). This is an optional value and the default is 5.
8. max_encp_retries: This allows an administrator to up the number of attempts encp can try to this library before it gives up because of two many errors. This is an optional value and the default is 3.
9. max_suspect_movers – This value is the number suspect movers that a single volume read or write can fail on before the volume is set NOACCESS. This is an optional field and the default is 3.
10. max_file_size: This represents the maximum filesize that can be

written to this library. This should be set to the maximum size of the associated media. If not present the default is 2GB - 2kb.

11. min_file_size: Minimum size that is allowed to write to tape. This would allow an administrator to prevent a user from writing small files into permanent media storage. This is an optional field and the default is 0.
12. CleanTapeVolumeFamily: This lists the volume family for the cleaning tapes belonging to this library manager.
13. suspect_volume_expiration_time: Duration a volume will remain blacklisted from a particular mover. See also—get-suspect-vols. The default time is 24 hours.
14. legal_encp_version: This is the oldest version of encp allowed to access the system. An example value would be **v3_7**. As of March 21st 2008 this value is **v3_6c**. This is an optional field.
15. lock: This is the default state the library manager will go into when started or the **enstore library –stop-draining** command is issued. The possible values are: pause, lock, noread and nowrite. See the section 1.8 for more information.
16. storage_group_limits – Sets the fair share limits for the specified storage groups to access tape drives. This is optional and by default there are no fair share limits.
17. max_requests – The maximum number of requests the library manager will place into the queue. An admin priority request will always be added to the queue, even if it means exceeding this limit. When the limit is reached and a new (non-admin) request arrives the library manager will reply to the the encp with a successfully queued request message, but will not add it to the queue. Encps resend pending requests every 15 minutes[7], if the queue is not full then, the request will be added to the queue. This is optional and the default .is 2000.

7 Encps resend pending requests every 15 minutes by default. It is possible to modify that time using the encp –resubmit-timeout switch.

8.4.11 mover

```
configdict['null.mover'] = {
    'host':'enmvr1a',
    'port':7530,
    'logname':'NULMV',
    'norestart':'INQ',
    'max_buffer':50*MB,
    'library':'null.library_manager',
#    'library':['test.library_manager', 'null.library_manager'],
    'device':'/dev/null',
    'driver':'NullDriver',
    'mc_device':'-1',
    'media_changer':'null.media_changer',
}
```

```
configdict['D31DLTO.mover'] = {
    'host': 'enmvr17a',
    'port': 7545,
    'logname': 'D31DMV',
    'noupdown':'dmb',
    'inq_ignore':'dmb',
#    'data_ip':'enmvr17a',
#    'do_eject':'yes',
    'statistics_path': '/tmp/enstore/enstore/D31DLTO.stat',
    'max_consecutive_failures': mvr_max_consecutive_failures,
    'max_failures': mvr_max_failures,
#    'failure_interval' : 3600,
    'compression':0,
    'check_written_file': lto_mvr_check_f,
    'max_buffer' : 1*GB,
#    'min_buffer' : 8 * MB,
    'max_rate':lto_rate,
    'mount_delay':30,
    'max_dismount_delay':max_dismount_delay,
    'dismount_delay':dismount_delay,
    'update_interval':5,
    'library': 'testlto.library_manager',
    'device' : '/dev/rmt/tps0d4n',
    'driver' : 'FTTDriver',
    'mc_device':'D31D',
    'media_changer':'aml2.media_changer',
    'syslog_entry':low_level_diag_pattern,
    'do_cleaning':'No',
    'norestart':'INQ',
#    'send_stats':1,
#    'connect_timeout' : 5,
#    'connect_retries' : 4,
    }
```

```
configdict['disk.mover'] = {
   'device':'/data',
   'type':'DiskMover',
   'host':'rain',
   'hostip':'131.225.84.108',
   'ip_map':'rain', #disk mover only
   'port':7531,
   'library':['disk.library_manager',] ,
   'driver':'DiskDriver',
   'mc_device':'1',
   'logname':'DISKMV',
   'update_interval':5,
   'connect_timeout':10,
   'connect_retries':15,
   }
```

- connect_timeout: The number of seconds to wait for a connection to the encp process to be established. Default is 15 seconds. This timeout is waited for `connect_retries` number of times.
- connect_retries: The number of times the mover tries to connect back to the requesting encp process. Default is 4 which yields 4 total attempts. The length of each connection attempt is defined by `connect_timeout`.
- dismount_delay: Number of seconds a mounted volume should stay mounted in a drive without a new request for the mounted volume. If the counter expires the volume is dismounted. This is useful in use cases where a new request might take longer than the default 60 seconds to arrive at the library manager; where it higher than 60 is hoped to prevent frequent mounts and dismounts of the same volume over and over again. Setting this value to high for general use may impact other requests waiting for a mover in an otherwise idle Enstore system. Setting this to a negative value will prevent the volume from being automatically dismounted. See the **encp --dismount-delay** switch for specifying this value for a single encp's amount of files.
- failure_interval: If the `max_failures` number of error occurs within this number of seconds the mover will go offline. Default is 3600 seconds (1 hour).
- get_remaining_from_stats:
- library: The name of the library manager to contact for work. This value can be a single string or a list containing the libraries to contact. The order the library managers are contacted is the order listed in the configuration.
- log_state:
- max_buffer: Maximum amount of memory the mover should use when buffing data on and off of tape. This value is optional and defaults to 8 MB in bytes.
- max_dismount_delay: Maximum number of seconds that can be set in

for the dismount delay. In a proper configuration this will always be grater than or equal to the dismount delay. This value is more useful as a way to limit the values specified using the **encp --dismount-delay** switch.

- max_consecutive_failures: This number of consecutive errors will set the mover offline. Default is 2.
- max_failures: This number of errors in the `failure_interval` will set the mover offline. Default is 3.
- max_in_state_cnt:
- max_rate: Highly recommended optional value to specify the maximum write rate of the drive. Defaults to 11.2 MB per second.
- max_time_in_state:
- media_changer: The name of the media changer to contact for mounting and dismounting volumes. This value is not specified for disk movers.
- min_buffer: Minimum amount of memory the mover allocates for buffering the data transfer. This value is optional and defaults to 64 MB in bytes.
- mount_delay: Number of seconds to wait after media changer mount completes before opening the tape device (i.e. /dev/rmt/tps0d0n or /dev/null). This is an optional value with the default for tape movers 15 seconds and for null movers 0 seconds.
- restart_on_error: The mover restarts itself automatically if it does into the error state. Default does not restart. Set to 1 to enable this feature. Most modern drives, like 9940A/B and LTO, are reliable enough that when the movers go into error state something is likely wrong.
- send_stats: Send the drive statistics to the drivestat server to be inserted into the drive statistics database table; which are used to populate the tape drive statistics web page. Optional boolean value; default is 1 for enabled.
- statistics_path:
- update_interval: Interval in seconds between requests of the mover to the library_manager requesting the next item in the queue. Optional value, default is 15 seconds. Smaller values are better when the use case is to submit one request at a time, instead of submitting multiple requests from the beginning.

The following are mover type specific values.

- device:
  - Tape movers: This represents the path to the tape drives device file. An example on Linux would be: /dev/rmt/tps0d1n.[8]
  - Disk movers: This represents the path to use for writing

8 The /dev/rmt/tps*d*n pattern is not the native Linux tape device. See the FTT mkscsidev.Linux utility for more information into creating Enstore compatible tape devices.

incomming files. If multiple disk movers are running on a single host, they should have unique paths.
    - Null movers: /dev/null
- driver:
    - Tape movers: FTTDriver
    - Disk movers: DiskMover
    - Null movers: NullDriver
- mc_device:
    - Tape movers: This field tells the mover the name the robot calls the attached tape drive. For STK robots an example value is the comma separated value: 1,1,10,8. For ADIC robots an example value is: D41D.
    - Disk movers: 1
    - Null movers: -1

The following are tape mover specific values.

- blank_error_increment:
- check_first_written_file: This enables a re-read of the first written file after a tape is mounted to recalculate and verify the CRC of the file on tape. Default is 0, which disables this check.
- check_written_file: This enables a periodic check after a file is written to tape. It looks for silent corruptions in the data while the file was being written. If this value is greater than 0, it randomly re-reads newly written files to recalculate the CRC as often as the value specifies. A value of 1 will run this check after every file. Default is 0, which disables this check.
- Compression: This is considered an optional configuration value. However, in almost every situation it should be set to 0. Anything else (including None) will enable drive compression of the data. Enabling drive compression is not recommended because of the reduced drive rates and compressing already compressed data (from compress or gzip) increases the size of the data on tape.
- do_cleaning: Enable the mover to clean the drive when the cleaning bit is set on the drive.
- do_eject: Eject the tape on dismount. This is enabled by default. Possible values are `yes` and `no`.
- media_type:
- single_filemark: Default value is 0. Recommended value is 1 for most modern drives. Some older drives (Mammoth 1 for example) designated End-of-Data with two consecutive file marks. Thus, it is important after every write for two file marks to be written. This has the downside that when writing many files sequentially, the tape first must be rewound to between the two file marks before the next file can be written. Stopping, rewinding and writing after each file takes a

longer time and puts more ware and tear on the tapes and the drives than does writing one file mark then starting to write the next file.

- syslog_entry: Expression to match in the Linux syslog for the low level drive failure diagnostics. This value is optional. A typical value is `sense|st[0-9]`when it is set.

The following are disk mover specific values.

- type: Technically, this is not specific to disk movers, but is only required to be set by them, since the default is for Tape/Null movers. The default is the empty string (“”), but the other possible values are: `Mover` and `DiskMover` for Tape/Null and Disk movers respectively.

8.4.12 media_changer

```
configdict['SL8500.media_changer'] = {
   'host':media_changer_host,
   'port':7508,
   'logname':'SL8500MC',
   'type':'STK_MediaLoader',
   'norestart':'INQ',
   'acls_host':'fntt-gcc',
   'acls_uname':'acsss',
   'DriveCleanTime':{'LTO3':[60,1],
                     'LTO4':[60,1],
                     },
   'tape_library':"GCC StreamLine 8500",
   }

configdict['aml2.media_changer'] = {
   'host':media_changer_host,
   'port':7525,
   'logname':'AML2MC',
   'type':'AML2_MediaLoader',
   'norestart':'INQ',
   'RobotArm':'Both',
   'IdleTimeHome':30000000,
   'DriveCleanTime':{'DE':[60,1],
                     'DC':[60,1],
                     'DM':[60,1],
                     'D3':[120,2]
                     },
   'IOBoxMedia':{'ACI_8MM':['E01','E08'],
                 'ACI_LTO':['E03','E05','E06'],
                 'ACI_DECDLT':['E02','E04','E07']},
   'tape_library':"D0 AML/2",
   }
```

4. type: This field declares the type of robot that this media changer will be interfacing with. Valid values for this field are:
    1. STK_MediaLoader for StorageTek (now Sun Microsystems) 9310 Powderhorn Silos and StreamLine 8500s.
    2. AML2_MediaLoader for ADIC (now Quantum) AML/2 Quadratower or the AML/J.
    - RDD_MediaLoader for manually loading a tape.
    - MTX_MediaLoader for Overland 8000 stackers.
    - IBM_MediaLoader for IBM robots using SMC.

It is important to note that there is not a media changer for disk volumes.

- DriveCleanTime:
- tape_library: This is the string identifying the associated robot. This is an optional value, but is very useful to differentiate robots for a site that has multiple robots of the same type (i.e. “STK Silo room1” and “STK Silo room2”). One ramification of not specifying this value will be that the Slot Usage and Drive Utilization plots will not be created.

For configuration items specific to the STK_MediaLoader:

- acls_host: The name of the host running the STK robot(s).
- acls_uname: The name of the user used to rsh as into the acls_host.

For configuration items specific to the AML2_MediaLoader:

- RobotArm: Specifies which side of the AML/2 the media changer controls. R1, R2, or Both are the valid values. For AML/J use R1.
- IdleTimeHome:
- IOBoxMedia:

For configuration items specific to Manual_MediaLoader:

- test: If this is any value that evaluates to boolean true; then the dialog box asking for confirmation that the tape has been inserted into the drive includes additional button choices. The additional button choices name specific errors to simulate for testing purposes.

Chapter 9: Restoring Enstore and PNFS databases

9.1 Rebuilding a PNFS database from an Enstore Database

However unlikely and unfortunately you may need to rebuild a set of PNFS database from the Enstore file and volume database. Some issues will arise from this. First, is that the database number in the PNFS IDs will almost certainly not match the new database number that will be assigned to the same database name. This will not pose a problem for the active files being restored, but maybe confusing for someone investigating what happened to a deleted file.

First, extract the tag information for each directory. This will dump the results into a text file, named /tmp/tag_dir_dump in the example, so that the directory structure complete with tags can be recreated. Most likely the default port (8888) and user/role (enstore) will be used; if on the same host as the database the "-h <hostname>" may be left off. The example also assumes that the enstore database name is enstoredb.

```
$ psql -h <hostname> -p 8888 enstoredb -U enstore -c "
select library, storage_group, file_family, wrapper,
       rtrim(pnfs_path,'0123456789abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMN
OPQRSTUVWXYZ._-+=') as dirname
from file, volume
where file.volume = volume.id
  and file.deleted = 'n';
" > /tmp/tag_dir_dump
```

Next, we find just the unique combinations of directories and tags. The first sed removes any empty lines. The second sed removes the first two lines and the last line. Then the list is sorted and the duplicate values are consolidated together.

```
$ sed '/^$/d' /tmp/tag_dir_dump | sed -e '1,2d' -e '$d' \
| sort | uniq -c > /tmp/tag_dir_dump_uniq
```

The new databases need to be (re)created. See the *PNFS Maintenance* chapter, section "Adding a new PNFS Database" for more information.

Use the information from the previous step to decide what are the appropriate tag values for the top directory for each PNFS database mount point. The directions for setting these top level tags are included in that text and not repeated here.

Now, the directory structure can be recreated. We simply loop over the unique list of

directories using mkdir -p. This is best done on a machine that has both the /pnfs/xyz and /pnfs/fs/usr/xyz style mount points mounted. Also, the node this command needs to be run as root on a trusted PNFS machine.

```
# awk '{print $10}' /tmp/tag_dir_dump_uniq | while read line; do
   echo mkdir -p $line;
   mkdir -p $line;
done
```

At this point, root owns all the newly created directories. They need to be set to each storage groups group UID and GID. This information is not in the Enstore DB, which requires some level of intuition to pick an appropriate value. And it is likely that some of them will end up incorrect. However, each user/group should be able to fix any remaining incorrect ownership issues on their own.

```
# chown -R <UID1>.<GID1> /pnfs/<mount_point_1>

# chown -R <UID2>.<GID2> /pnfs/<mount_point_2>
```

The tags also need to be corrected to reflect where new files should be written. The following command will report on differences between tags. Note: directories with multiple libraries specified will not be caught by this check; those need to be handled by the administrator doing the rebuild.

```
# cat /tmp/tag_dir_dump_uniq | while read line; do
   #Get the tags from the database dump.
   library=`echo $line | awk '{print $2}'`;
   storage_group=`echo $line | awk '{print $4}'`;
   file_family=`echo $line | awk '{print $6}'`;
   wrapper=`echo $line | awk '{print $8}'`;

   #Get the directory we are currently looking at.
   dname=`echo $line | awk '{print $10}'`;
   if [ -d $dname ]; then
      #Get the tags currently in pnfs.
      p_library=`enstore pnfs --tag library $dname`;
      p_storage_group=`enstore pnfs --tag storage_group $dname`;
      p_file_family=`enstore pnfs --tag file_family $dname`;
      p_wrapper=`enstore pnfs --tag file_family_wrapper $dname`;

      #Report which tags differ from what PNFS currently has.
      if [ "$library" != "$p_library" ]; then
         echo "library ($p_library, $library) differs for $dname";
      fi;
      if [ "$storage_group" != "$p_storage_group" ]; then
         echo "storage_group ($p_storage_group, $storage_group) differs
for $dname";
      fi;
      if [ "$file_family" != "$p_file_family" ]; then
         echo "file_family ($p_file_family, $file_family) differs for
$dname";
      fi;
      if [ "$wrapper" != "$p_wrapper" ]; then
```

```
         echo "wrapper ($p_wrapper, $wrapper) differs for $dname";
      fi;
   else echo "$dname does not exist";
   fi;
done
```

Dump the non-deleted bfids from the database. Migration originals and duplication/multiple copies need to be handled special.

```
$ psql -h <hostname> -p 8888 enstoredb -U enstore -c "
--Find normal file bfids, skip migration originals, skip multiple copies.
select file.bfid
from file
where deleted = 'n'
  and bfid not in (select alt_bfid
                   from file_copies_map
                   where alt_bfid = file.bfid)
  and bfid not in (select src_bfid
                   from migration
                   where src_bfid = file.bfid)
union
--Find duplication primary bfids.  This includes multiple copies.
select file.bfid
from file,file_copies_map
where deleted = 'n'
  and file.bfid = file_copies_map.bfid
" > /tmp/bfids_to_restore
```

Then loop over the bfids recreating the files.

```
# cat /tmp/bfids_to_restore | while read line; do
   echo $line;
   enstore file --restore $line --force;
done > /tmp/file_rebuild_log 2>&1
```

9.2 Rebuilding an Enstore DB from a PNFS database

This direction of rebuild is more painful than the other way around. Deleted files will not be able to be recovered. This will leave confusing gaps in tape lists.

Warning: This documentation is untested, but should provide a basis for performing this operation.

We need to obtain a list of all files in PNFS. This list may be able to be obtained from the COMPLETE_FILE_LIST page from the Inventory Summary.

```
$ wget http://www-stken.fnal.gov/enstore/tape_inventory/COMPLETE_FILE_LISTING
```

or

```
$ find /pnfs/fs/usr -type f > COMPLETE_FILE_LISTING
```

Note: The column position of the file name will be in different depending on which method was used. For the former, it is 8 and 1 one for latter.

```
$ for item in `cut -f [1 | 8]-d " " /tmp/COMPLETE_FILE_SYSTEM`; do
   layer4=`enstore pnfs --layer $item 4`;
   volume=`echo "$layer4" | sed -n 1p`;
   lc=`echo "$layer4" | sed -n 2p`;
   size=`echo "$layer4" | sed -n 3p`;
   fname=`echo "$layer4" | sed -n 5p`;
   pnfsid=`echo "$layer4" | sed -n 7p`;
   bfid=`echo "$layer4" | sed -n 9p`;
   drive=`echo "$layer4" | sed -n 10p`;
   crc=`echo "$layer4" | sed -n 11p`;
   uid=`ls -ln $item | awk '{print $3}'`;
   gid=`ls -ln $item | awk '{print $4'}`;

   sg=`echo $fname | sed -e 's:/pnfs/fs/usr/::' -e 's:/pnfs/::' | tr '/' '
' | awk '{print $1}'`
   ff=`echo "$layer4" | sed -n 4p`;

   #Make sure that we have valid information from layer 4.
   if [ -z "$volume" ]; then continue; fi;

   #Determine if volume has been added already.
   grep $volume /tmp/vol_list
   if [ $? -eq 1 ]; then
      #Add volume to DB.
      enstore volume --add $volume UNKNOWN $sg $ff UNKNOWN UNKNOWN
UNKNOWN;
   fi

   #Add the file to the DB.
   enstore file --add $bfid pnfs_name0=$fname complete_crc=$crc size=$size
pnsfid=$pnfsid deleted=n drive=$drive external_label=$volume
location_cookie=$lc uid=$uid gid=$gid;
done
```

The values for the UNKNOWN volume fields above need to be corrected.

- For NULL volumes (which should be easy to identify from the volume name):
  - library will be the null library from the configuration.
  - wrapper will be 'null'.
  - media_type will be 'null'
  - capacity will be some large made up value.

- For tape volumes:
  - library will be matching library for the media type. The few “test” volumes belonging to test libraries can be fixed later.
  - The file locations will need to be evaluated to identify any cern wrapper tapes. cpio_odc wrapped tapes write files to all locations, while cern wrapper wrapped tapes skip locations where the file headers and footers are written. File sizes larger than 8GB can only be written to cern wrapper volumes; this may provide a clue for some volumes.
  - For the media_type, a dump of volume information from the robots should provide enough of a clue to set these values.
  - Once the media_type is known, the capacity can be calculated.
- For disk volumes (which should be easy to identify from the volume name):
  - The library will be the disk library from the configuraiton.
  - wrapper will be 'null'.
  - media_type will be 'disk'
  - capacity will need to be some made up value. The most correct thing to do would be to base it on the size of the file system that the file is stored on.

Chapter 10: Metadata Scanning

Metadata scans can also be called an audit of the content of the PNFS databases against the content of the Enstore database. These scans are done in two directions:

- Forward scan: Walks through the PNFS namespace and compares the metadata with that in the file and volume tables in the Enstore database.
- Reverse scan: Obtains the records of every file in the file table and compares them with the contents in PNFS.

10.1 Recommendations

27. Do not run a full scan on any production system. Scanning a file here or there is fine on a production system, but do full scans on offline copies from recent backups of the Enstore and PNFS databases.

10.2 Requirements

1. The scan must be run with UID 0, i.e. as root. Failing this, some Chimera layer information files with restricted access cannot be read.

10.3 Execution

10.3.1 enstore scan

The method of evoking a forward scan is to pass it a file(s) or directory(ies). If a directory is passed to `enstore scan` it will recursively check all files underneath the specified directory.

```
# enstore scan [target1] [target2 [target3 ...]]
```

There are two ways of doing a reverse scan. The first is to use it on a BFID(s). The second is to use it on a volume(s) which causes a lookup of all files on the tape in the Enstore DB to obtain a list of BFIDs, then a scan on that list of BFIDs is done in the same way the `--bfid` scan is performed.

```
# enstore scan --bfid [bfid1] [bfid2 [bfid3 ...]]

# enstore scan --vol [vol1] [vol2 [vol3 ...]]
```

If no files, BFIDs or volumes are listed on the command line; `enstore scan` will read from stdin for a list of respective targets.

10.3.2 Starting full scans

There exists two scripts: `forward_scan` and `reverse scan`. The optional parameter is a file consisting of what it plans to scan. For a forward scan it will contain a list of PNFS mountpoints; one on each line. For a reverse scan it will contain a list of storage groups; again one on each line. It is possible to pass an edited version of these files named all_mount_points and all_storage_groups to the script to scan only a desired sub-set of targets.

```
# forward_scan [all_mount_points_file]

# reverse_scan [all_storage_groups_file]
```

For Enstore systems with multiple PNFS servers, on reverse scans it is necessary to hand edit the all_storage_groups_file to select only the storage groups assigned to the restored PNFS namespace(s). For forward scans the all_mount_points_file also needs to be updated to only look at PNFS namespaces that were restored on the offline node.

To aid in the creation of these edited list files; the scripts `mount_points` and `storage_groups` can be run to generate the default list of mount points or storage groups detected without actually starting the `forward_scan` or `reverse_scan`; these are the underlying scripts used by `forward_scan` or `reverse_scan`.

10.4 Output

Each file is listed on one line with one of three classifications: ERROR, WARNING or OK. ERRORs indicate that the scan found something that will require intervention to fix. These range from annoyances to really bad problems. WARNINGs are usually (though not all of them) for files that errors were found, but are so new that they have a high chance of still being written to tape. These WARNINGs should simply be rerun at later time to weed out any false positives.

It is recommended that the list of ERRORs and WARNINGs be re-run against the production system. Files that come up as OK or "does not exist" no longer need to be worried about.

Other output is the creation of the directory to hold the scan results that typically look like 'SCAN_09_01_2006.' In this directory will be a forward_scan.status or reverse_scan.status file and files containing the output from "`enstore scan` ..."

10.5 Fixing common errors:

Most of these scripts will accept raw output from `enstore scan`. They will
simply strip away everything after the first " ... " found.

In the following examples using **sclient** the default value of 1122 is used for the PNFS shared memory key. The actual key value can be found in the /usr/etc/pnfsSetup file on the **shmkey** line.

10.5.1 size

Here is a sample size error. The file DB and layer 4 sizes agree, but the stat() size (in the middle) is zero. If the size mismatch errors do not fit this pattern then a more detailed investigation needs to be done than this description can give.

```
/pnfs/mist/NULL/1KB_093 ... size(1024, 0, 1024) ... ERROR
```

To fix this from the command line:

```
# enstore pnfs --size  <filename> <size>
```

10.5.2 found temporary file

These should just be removed. In most cases using rm is sufficient. Take note if "invalid directory entry" also appears in the `enstore scan` output. This means that the entry in the directory listing does not point to an existing file (but to a ghost file).

To convince oneself that everything is fine see the section “Removing Invalid Directory Entries” in the “PNFS Maintainence” chapter or the “Invalid Directory Entry” section later on in this chapter for instructions on detecting invalid directory entries.

10.5.3 deleted

This likely means that the offline pnfs server sill contains the file, but: the file has been removed from the production pnfs server, delfile.py marked the file deleted and the scan found this discrepancy with the offline pnfs server.

If a rerun of the scan of these files on the production pnfs server gives "does not exist" then the user deleted the file and everything is okay. If the file rescans as OK there also is nothing else to do. If the error remains "deleted" then there is a conflict between the Enstore and PNFS databases. In most cases (but not all) the simplest thing is to unmark the file as deleted in the file DB.

```
$ enstore file --bfid  <BFID> --deleted no
```

10.5.4 missing file

The file has no size, no layer 1, no layer 2 or layer 4. It is as if the user simply touched the file. The best thing to do is to contact the experiment and ask them about these files. It is best if they can be rewritten, otherwise the owner should remove them from PNFS.

10.5.5 does not exist

The file has been removed from PNFS. There is nothing to do.

10.5.6 younger than 1 day

This is a warning. It says that the file is very new and has not finished writing to tape. Check the file again after a day or so.

10.5.7 missing the original of link

This is also a warning. The target of the link is not found. The owner of the link should be notified. Especially, if the link points to files not in the PNFS namespace.

10.5.8 reused pnfsid (reverse scan)

In all likelihood the file received an error while witting to tape and a retry succeeded. The files in question should be marked as deleted.

```
$ enstore file --bfid <BFID> --deleted yes
```

Take care to make sure that these BFIDs are not for multiple copies; multiple copies do share PNFS IDs with the current primary file. An early version of `enstore scan` did not check if a file was a duplicate before giving this error.

10.5.9 invalid directory entry

These errors occur when a hard link succeeds to create the new directory entry, but fails to update the link count. This is a similar situation

to the "duplicate entry" errors described below.

To confirm the problem:

```
# cd <broken dir>

# ls | grep <basename>       #will take a while for large directories.

stat <basename>
```

If the "ls | grep" says the file exists, but stat says "No such file or directory" then this is a corrupted files (A.K.A. ghost file).

```
# ls | grep 0_p18.05.00.root
0_p18.05.00.root
# stat 0_p18.05.00.root
stat: cannot stat `0_p18.05.00.root': No such file or directory
```

To fix the problem (as root and the broken directory is the current working directory):

```
# cd <broken dir>

# /opt/pnfs/tools/sclient rmdirentry 1122 `enstore pnfs --id .` <basename>
```

For example:

```
# /opt/pnfs/tools/sclient rmdirentry 1122 `enstore pnfs --id .`
0_p18.05.00.root
```

10.5.10 duplicate entry

If you list the directory with the duplicate error you will see something like:

```
# ls
all  all  all
```

To see what PNFS see internally use the scandir.sh script.

```
# /opt/pnfs/tools/scandir.sh
000900000000000000163470 000900000000000000163430 0000000000000000 0 all
000900000000000000163470 0009000000000000003525B8 0000000000000200 1 all
000900000000000000163470 0009000000000000003525B8 0000000000000200 2 all
```

15. The first column lists the PNFS IDs of the directory bucket that each file entry is located in.
16. The second column lists the PNFS ID for the file entry in the directory.
17. The third column is PNFS specific information.
18. The fourth column is the position on the file entry within the directory bucket.
19. The fifth column is the filename of the file in this directory.

There is a serious complication when different files might be hidden behind

the first entry in the directory. The first one listed is the path that gets used by UNIX and Enstore commands. To illustrate this obtain the PNFS ID from the filename. The following example shows how it matches that of the first line of scandir.sh output.

```
# enstore pnfs --id all
```

```
000900000000000000163430
```

Also, the link count might be different from the number of hard links there really are. In the following "stat" examples the link counts are consistent, but the hidden "all" entries are files not directories.

```
# stat ".(access)(000900000000000000163430)"
```

```
  File: `.(access)(000900000000000000163430)'
  Size: 512             Blocks: 1          IO Block: 512    Directory
Device: ah/10d  Inode: 152450096   Links: 1
Access: (0755/drwxr-xr-x)  Uid: ( 7816/     sam)   Gid: (    0/    root)
Access: 2006-03-24 10:36:01.000000000 -0600
Modify: 2006-03-24 10:36:01.000000000 -0600
Change: 2001-06-12 14:51:51.000000000 -0500
```

```
# stat ".(access)(000900000000000000003525B8)"
```

```
  File: `.(access)(000900000000000000003525B8)'
  Size: 0               Blocks: 0          IO Block: 512    Regular File
Device: ah/10d  Inode: 154478008   Links: 2
Access: (0644/-rw-r--r--)  Uid: ( 7816/     sam)   Gid: ( 1507/    e740)
Access: 2001-09-15 00:50:07.000000000 -0500
Modify: 2001-09-15 00:50:07.000000000 -0500
Change: 2001-09-15 00:50:07.000000000 -0500
```

If necessary (the example does not need this) modify link count (assuming CWD is the broken directory):

```
# /opt/pnfs/tools/sclient modlink 1122 <file id> <link diff>
```

"link diff" will be negative to shrink the link count.

If necessary add or remove the links (assuming CWD is the broken directory):

```
# /opt/pnfs/tools/sclient rmdirentry 1122 `enstore pnfs --id .` <name>

# /opt/pnfs/tools/sclient adddirentry 1122 `enstore pnfs --id .` <name>
<pnfsid>
```

For this example, to create new directory entries for the unaccessible "all" files in the example:

```
# /opt/pnfs/tools/sclient adddirentry 1122 `enstore pnfs --id .` all2 \
000900000000000000003525B8

# /opt/pnfs/tools/sclient adddirentry 1122 `enstore pnfs --id .` all3 \
000900000000000000003525B8
```

At this point the output from scandir.sh is:

```
# /opt/pnfs/tools/scandir.sh
```

```
000900000000000000045ED60 000900000000000003525B8 0000000000000000 0 all2
000900000000000000045ED68 000900000000000003525B8 0000000000000000 0 all3
```

```
000900000000000000163470 000900000000000000163430 0000000000000000 0 all
000900000000000000163470 000900000000000003525B8 0000000000000200 1 all
000900000000000000163470 000900000000000003525B8 0000000000000200 2 all
```

Continuing to use the output from `scandir.sh`; we can not just use `rm` on "all" here[9]. We need to remove the extraneous directory entries pointing to "all." The rmdirentrypos command removes directory entries based on their position within the directory.

```
# /opt/pnfs/tools/sclient rmdirentrypos 1122 000900000000000000163470 \
000900000000000003525B8 1

# /opt/pnfs/tools/sclient rmdirentrypos 1122 000900000000000000163470 \
000900000000000003525B8 2
```

At this point the output from scandir.sh is:

```
# /opt/pnfs/tools/scandir.sh
000900000000000000045ED60 000900000000000003525B8 0000000000000000 0 all2
000900000000000000045ED68 000900000000000003525B8 0000000000000000 0 all3
000900000000000000163470 000900000000000000163430 0000000000000000 0 all
```

Note: The output from `ls` may be old due to file system caching (especially on Linux):

```
# ls
all  all  all2  all3
```

To fix this:

```
# umount /pnfs/fs && mount /pnfs/fs
```

And ls will then give:

```
# ls
all  all2  all3
```

10.5.11 parent id

The most common cause of this error is using `mv` to move a file to another directory and PNFS only partially updates its internal metadata. An incorrect parent ID will cause the `enstore pnfs –path <pnfsid>` command to break, because it uses parent IDs to determine the current path of the file.

The tricky part of this error is that it may be a valid file. If there are two hard links to the i-node from different directories one of the pathnames will give this error while the other will not.

Once it has been decided if/when that the parent ID is wrong, and not a second

9 In most cases the same PNFS ID is repeated for each directory entry. For these simple cases it would be sufficient to just use rm; once for each extra file entry. In this complicated example, that is insufficient to remove "all", because it would remove the 0 position directory first, not the 1 and 2 position files of the just created unique directory entries "all2" and "all3."

hard link use the following to change the parent ID of the specified PNFS ID.

```
# /opt/pnfs/tools/sclient chparent 1122 <objectPnfsID> <newParentID>
```

Alphabetical Index